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ABSTRACT

These materials are for use by elementary and middle school teachers in the state of Illinois. This document contains five modules for teaching land use and solid waste concepts. Topics include: (1) "Earth's Closed System"; (2) "Waste Alert"; (3) "Solid Waste/Litter"; (4) "Hazardous Waste"; and (5) "Recycling." Each module contains student resources such as text, maps, handouts, and diagrams; classroom materials such as posters; and activities such as projects, experiments, games, and puzzles. In several modules, supplemental and extension activities are suggested. (CW)

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THE LAND WE DEPEND ON

Fifth Grade
(Materials may be duplicated for classroom/activity use)

Office of Public Information/
Division of Land Pollution Control

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1989

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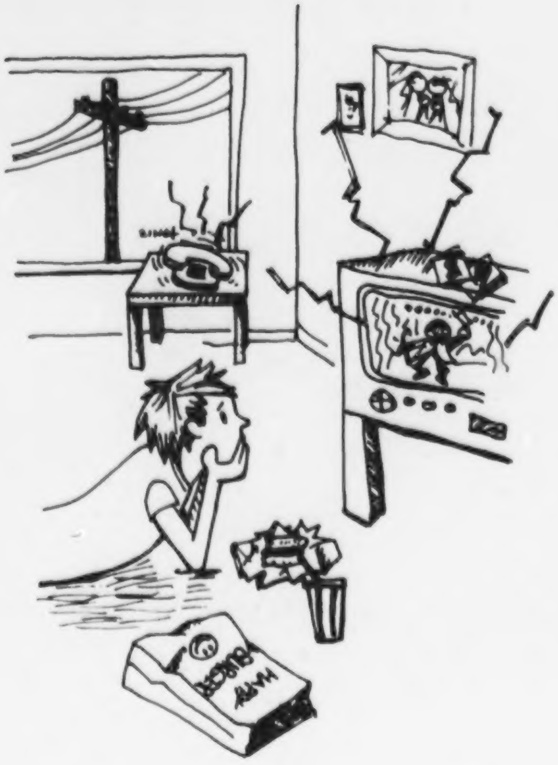
MODULE 1: Earth's Closed System

Student Resources	*Earth's Closed System (Text)* *Earth's Closed System (Diagram)*
Classroom Materials	*Groundwater and Land Use in the Water Cycle (Poster)* *A Clean Environment is the Goal of the Illinois Environmental Protection Agency (Poster)*
Activities	*Earth's Closed System (Worksheet)* *Toxics and Living Things (Experiment)* *The Environment Makes Headlines (Project)* *Environmental Times (Project)*

1

EARTH'S CLOSED SYSTEM



Your birth made an impact on the world. You were a new person for the world to feed, clothe and shelter.

Today, you are still making an impact on the world. When you turn on the TV or turn up the heat in your home, you use energy - gas, oil, or electricity. When you bite into a hamburger from a fast food restaurant, you benefit from the work of the farmers who raised the cattle and the industries that made the hamburger packaging.

The way that people produce food, energy and other resources you enjoy can keep your environment wholesome and clean, or make it dirty and polluted. The study of these relationships between living things and their surroundings is called **ecology**.

The way that you use those resources can also affect the environment. You decide what products to buy, what to repair, what to throw away. As you grow up, you will also decide about laws and government policy. Your decisions can make the environment better or worse.

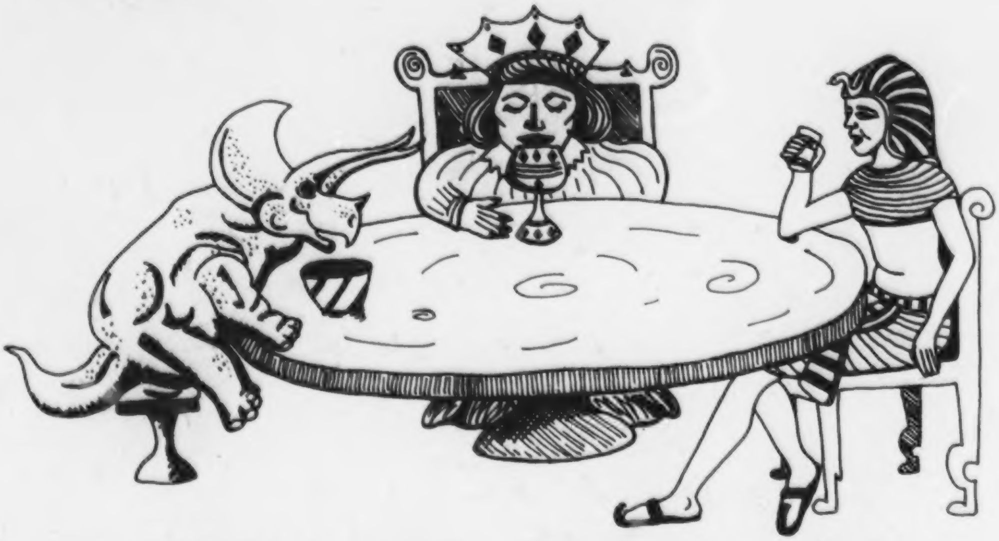
Our current methods of meeting our needs create environmental problems and cause pollution. **Pollution** is whatever makes our air, land and water dirty and unhealthy.

Burning fuel to make electricity for houses and factories can pollute (make dirty and unhealthy) the air we breathe by filling it with smoke, dirt and chemicals. Mining for the fuel and materials to make the things we buy can pollute water. For example, rain can wash soil and acids around mining sites into nearby rivers and lakes.

Wastes from manufacturing and disposal of garbage can pollute land, water and air. Chemicals sprayed on crops and those added to food, lotions and cleaning agents may end up harming us.

Many of the things we do and want cause pollution. Whether we pollute the environment or not depends on how we produce the things we want.

A Closed System



You have something in common with Egypt's King Tut, who lived thousands of years ago, and with Britain's Queen Elizabeth, who is living today.

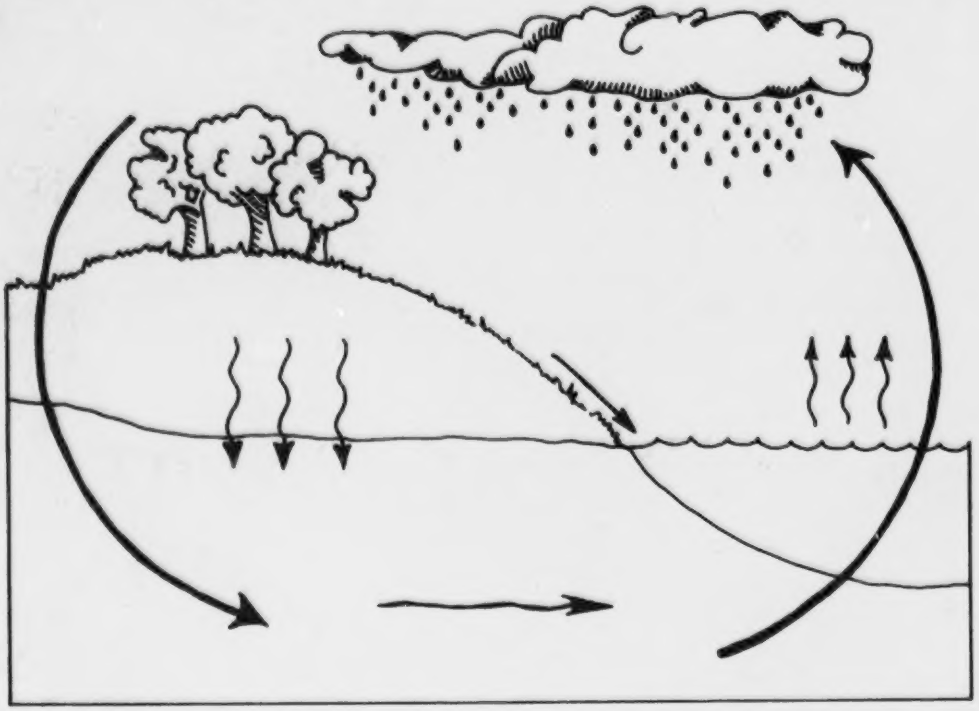
The water you drink today may contain atoms drunk by dinosaurs millions of years ago. And your favorite person in history may have breathed some of the same air you are breathing now.

It seems incredible that people and animals so far apart in time and space could share anything at all. But anyone who has ever lived has breathed the same air and used the same water that you use today and your children will use in the future.

This is because earth is a **closed system**. The air and water now on earth have always been here. Earth gets no new supplies from space.

Nature uses air and water again and again. This is called **recycling**. Energy in the form of sunlight provides the power for recycling by nature.

Take water, for example. It falls to the ground as rain or snow. From there some of the water soaks deep into the ground and becomes **groundwater**. Some runs off the land into rivers and lakes and becomes **surface water**. Sooner or later both the surface water and much of the groundwater



reach the ocean. At the surface of the ocean and the land, heat from the sun evaporates water. It rises as vapor into the air to make clouds. Eventually, the very same water falls back to earth as rain or snow, and the **water cycle** begins again.

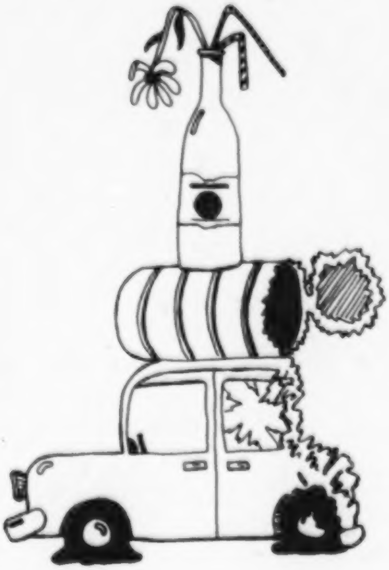
When you pour a glass of water down a drain in your house, it goes through underground pipes, and eventually rejoins the never-ending cycle of water from land to air and back again.

The same is true of the air we breathe. No "new" air is ever added to earth. Instead, green plants clean "used" air. To grow, plants use sunlight and the carbon dioxide that people and animals breathe out, and they produce the oxygen we need to breathe in. In biology, this process is known as the **carbon cycle**, nature's way of recycling the air. In the earth's atmosphere, carbon dioxide, an odorless, colorless and tasteless gas is converted into energy-rich carbohydrates in plants through a process called photosynthesis. Living organisms like human beings and animals use carbohydrates as food. Carbohydrates are stored in your body as fat. When you exercise, this body fat is converted to energy. Respiration (breathing) releases carbon dioxide and water back into the air. These two compounds are necessary for plant photosynthesis in sunlight to complete the carbon cycle.

Nature's way of recycling resources like air and water has always worked very well. Wood, wool, cotton and other materials produced by living things are **biodegradable**, that is, they can be broken down into atoms when eaten by insects, bacteria and fungi. The atoms are recycled into new materials. For example, the atom may become mineral matter dissolved in water that plants soak up through their roots.

But in the last hundred years or so, things have become more complicated. Some materials that are made by people cannot be recycled by nature. These man-made materials include many plastics, detergents and chemicals. They cannot be eaten by insects, bacteria, fungi, or any other living thing. Thrown away in the trash, dumped into water or carelessly sprayed in the air, these man-made materials are not destroyed. Instead, they remain as they are - often poisoning the environment and becoming pollutants.

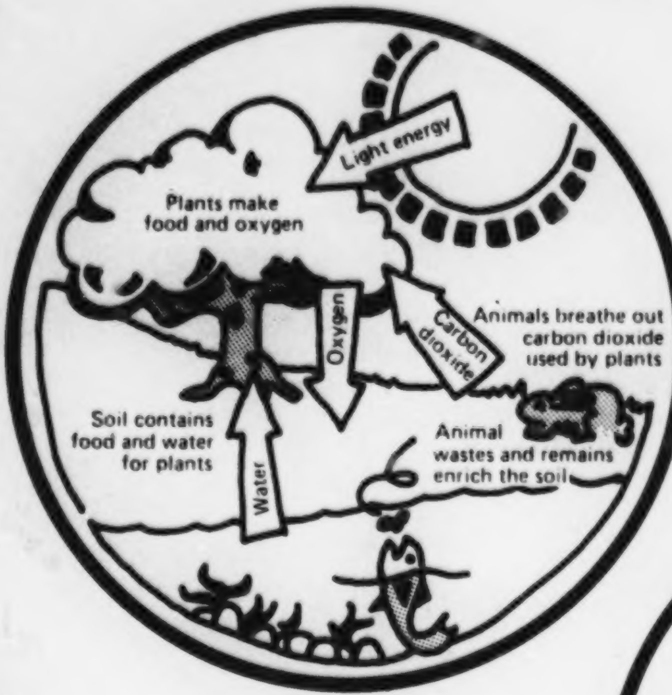
There are still other materials, such as iron, copper and glass, that are recycled in nature, but very slowly. These materials must be dissolved in water before living things can absorb them. And it may take many years before they are dissolved. The cans and junk cars that litter our countrysides are examples of the environmental problems caused by slowly dissolving materials. They also pollute.



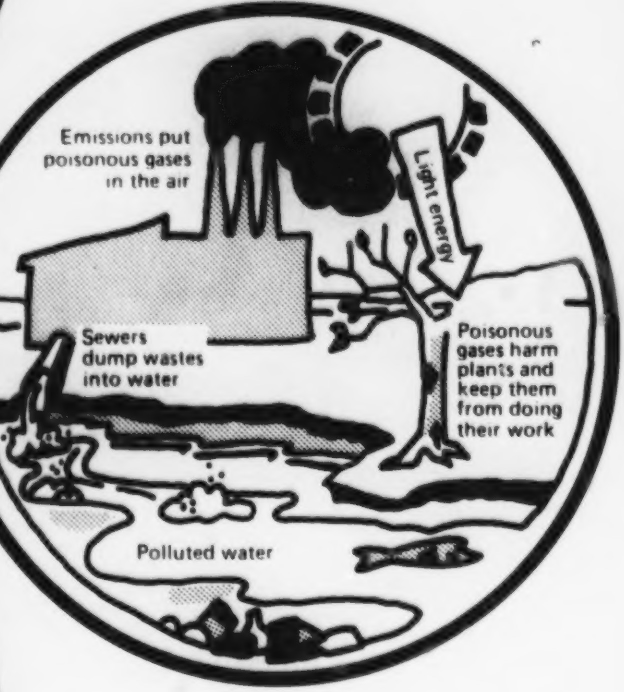
The number of people on earth is always growing. More people need more things: more food, more houses, more cars. Making these things will produce more pollution, unless people control it. So it is important to remember one thing: *if people create pollution, they can also control it.*

Handout

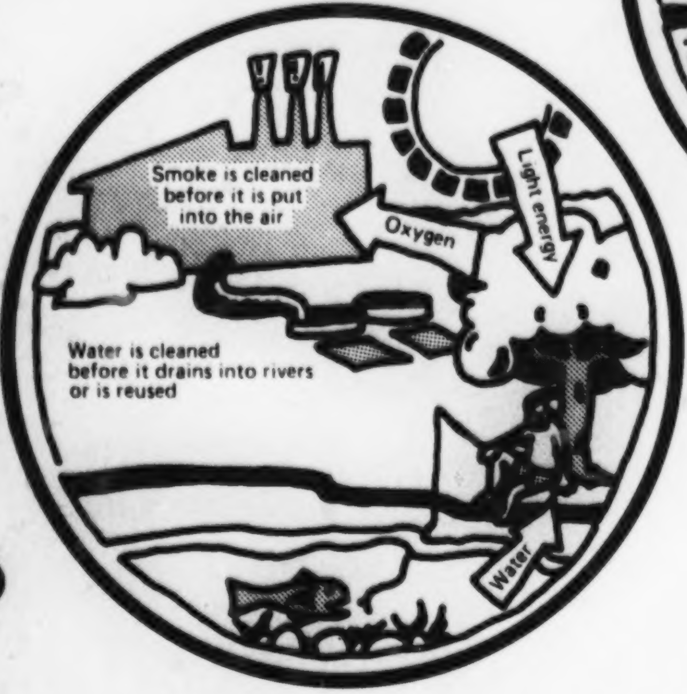
Earth's Closed System


Light energy
Plants make food and oxygen
Oxygen
Carbon dioxide
Animals breathe out carbon dioxide used by plants
Soil contains food and water for plants
Water
Animal wastes and remains enrich the soil

Natural Environment


Emissions put poisonous gases in the air
Light energy
Sewers dump wastes into water
Poisonous gases harm plants and keep them from doing their work
Polluted water

Polluted Environment


Smoke is cleaned before it is put into the air
Oxygen
Light energy
Water is cleaned before it drains into rivers or is reused
Water

Clean Environment

Worksheet

Name______________

EARTH'S CLOSED SYSTEM

New Words - Use the Dictionary of Environmental Terms to define the following words:

closed system
ecology
plastics
groundwater
surface water
contaminate
recycle
resources
biodegradable
environment
pollution
water cycle
decay

Fill-In-the-Blanks

1. ________________ is whatever makes our air, land and water dirty and unhealthy.

2. A system such as a spaceship or Earth in which energy, but not matter, can be exchanged with surrounding space is a ______________________.

3. Materials that can not be recycled by nature include _____________, detergents and chemicals.

4. Materials that can be broken down by microscopic plants and animals are ___________________.

5. __________________ is the supply of water under the earth's surface that forms natural reservoirs.

Short Answer

1. What are some causes of air, water and land pollution?

2. What do you have in common with King Tut and Henry VIII?

Answer Key

EARTH'S CLOSED SYSTEM

New Words - Use the Dictionary of Environmental Terms to define the following words:

closed system
ecology
polluters
groundwater
surface water
contaminate
recycle
resources
biodegradable
environment
pollution
water cycle
decay

Fill-in-the-Blanks

1. *Pollution* is whatever makes our air, land and water dirty and unhealthy.

2. A system such as a spaceship or Earth in which energy, but not matter, can be exchanged with surrounding space is a *closed system*.

3. Materials that can not be recycled by nature include *plastics*, detergents and chemicals.

4. Materials that can be broken down by microscopic plants and animals are *biodegradable*.

5. *Groundwater* is the supply of water under the earth's surface that forms natural reservoirs.

Short Answer

1. What are some causes of air, water and land pollution?
Answers will vary but should include actions discussed in the last paragraph on page five and the first paragraph on page six of the text.

2. What do you have in common with King Tut and Henry VIII?
You may be breathing some of the same air they breathed and drinking water containing some of the same atoms they drank.

Experiment

TOXICS AND LIVING THINGS

OBJECTIVES: To find out how some substances can be toxic to living things.

MATERIALS: Two containers such as flower pots or plastic cups, two plants, soil, salt, water, measuring cup

PROCEDURE: Place soil in the containers. Put one plant in each container and place in a sunny spot. Keep the soil moist. Water one plant regularly with ordinary tap water. Water the other plant regularly with a combination of tap water and salt.

EVALUATION:

- What happens to each plant?
- What does this tell you about the effect of certain substances on living things?

Project

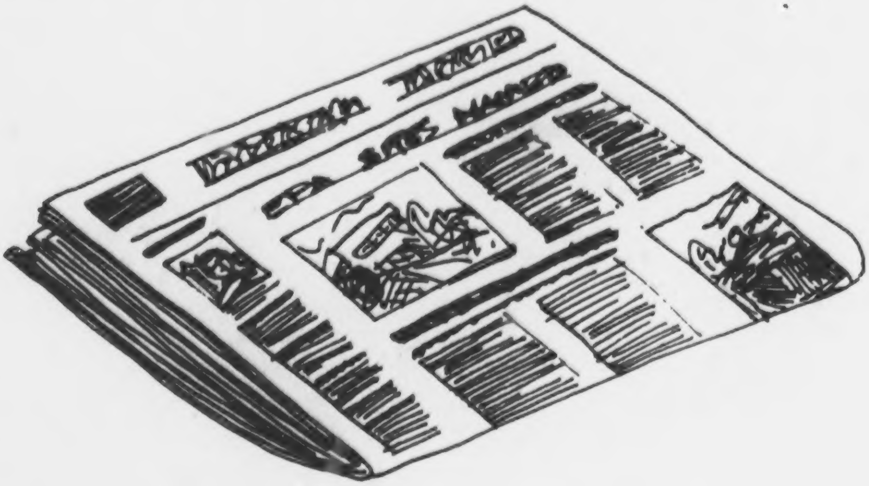
THE ENVIRONMENT MAKES THE HEADLINES

OBJECTIVE: To observe the daily news coverage of stories regarding the environment.

BACKGROUND: The environment often makes the headlines, or tops a radio or television newscast. The stories may range from a proposed landfill site to a citizen's group recycling aluminum and newspapers.

MATERIALS: Daily newspapers.

EXTENSION: 1) Have students observe the daily news coverage regarding stories about the environment. The source can be either television, radio, or newspapers. 2) The students then write a report about the news story regarding the environment. 3) The entire class may want to chart how much news coverage is given to environmental issues by your local media.



Project

ENVIRONMENTAL TIMES

OBJECTIVES: Students will be able to: 1) identify a diversity of issues related to environmental issues, and 2) develop their own opinions concerning some issues involving environmental pollution.

METHOD: Students investigate, write and produce a newspaper that features environmental information and issues.

BACKGROUND: In any classroom there is a wide range of learning styles and skills among the students. The production of a newspaper requires an array of skills that include art ability, graphic sense and design capabilities. Such an effort has a high likelihood of addressing many of the diverse skills possessed by various class members.

This activity provides an opportunity for the students to coordinate newspaper production with information, issues and recommendations about environmental issues.

The major purpose of this activity is to familiarize students with a range of environment-related topics and issues.

MATERIALS: Library resources: current nature magazines (Ranger Rick, National Geographic, etc.); writing materials. Optional: typewriters, cameras, tape recorders, computer.

PROCEDURE: 1) Using an actual newspaper as a model, discuss the various parts of a newspaper. Help the students recognize that in addition to news articles, many special interest departments exist in most newspapers. Comics, sports reports, editorials, commentary, home making articles, want ads, political cartoons, food and nutrition features, entertainment information, business columns, weather predictions, daily horoscopes, obituaries and many other sections are available. Also draw attention to advertisements. Ask each student or team of students to choose one section to plan and write. NOTE: *The whole activity could be modified to be a television news broadcast, where the students each help to report orally.*

2) Begin the research phase, asking the students to gather information and ideas for their chosen section. Tell them that whatever they compile has to relate to animals and plants, animal habitats, or environment-related issues. Show the students how to properly acknowledge and credit any sources they use. Each section should include a combination of information

and the students' opinions, based on what they learn through their research. NOTE: *If using the optional materials, familiarize the students with any resources they can use such as tape recorders, word processors, software, cameras, etc.*

3) Try to set the stage for both playful and serious reporting.

4) Once the information accumulates and writing begins, encourage the students to share their work with each other. In this way, interests can merge and different talents can be called on. Keep the students on track, making sure their writing is accurate even though they may have chosen humor or satire as their approach.

5) When enough work is completed, begin the production phase of the paper (or preparation for the news broadcast). At this point artwork can be done to accompany the stories. The artwork can be in color or black and white and can involve computer graphics. If possible, the stories should be typed or written neatly in a specified column format (3 1/2 or 4 inches wide works well).

6) The next step is the layout and design. A small group should be assigned the responsibility, but with input from everyone.

7) Once the newspaper is complete, you may investigate the possibility of having copies made for each child. Most communities now have fast copy facilities that can print oversize papers. (It might be well to check ahead of time to be sure the format can be copied.)

8) Culminate the activity with a discussion of each article or feature, emphasizing what can be learned about animal life and habitat from its content. Circulate the finished newspaper - for example, by posting copies on school bulletin boards.

EXTENSIONS: 1) Establish a current events corner about wildlife. 2) Develop advertisements based on a policy for accepting advertisements for products or services that are beneficial to the environment. 3) Convert the newspaper to a video news format. 4) Visit a local newspaper; offer them any of the students' articles for their use.

MODULE 2: Waste Alert

Student Resources	*Waste Alert (Text)* *What's In Our Garbage? (Handout)* *The History of Garbage (Text)*
Classroom Materials	*The History of Garbage (Poster)*
Activities	*Trash Can Inventory (Activity)* *Trash Can Inventory (Worksheet)* *A Trash Trivia Crossword Puzzle (Activity)* *Out of Sight, Out of Mind (Activity)* *Class Trash (Activity)*

2

WASTE ALERT

We generate a staggering amount of waste each year. It comes from industries that provide the goods we demand, from agriculture which provides our food, from businesses that provide services we request and from our homes in the form of trash and garbage.

Wastes are generally divided into nonhazardous, solid wastes — the ordinary trash and garbage thrown away by households and businesses (called "solid wastes" whether they are solid, liquid, or gaseous) — and hazardous, which means that the waste materials could severely harm the environment and threaten our health and safety if not handled properly.

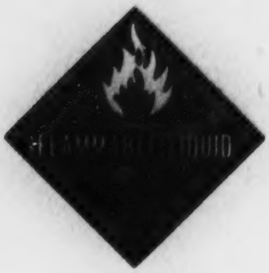
Solid Wastes

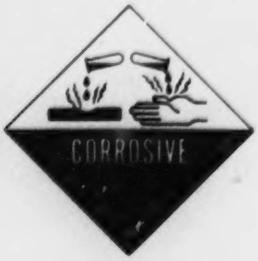
Solid waste includes such diverse items as paper, grass cuttings, derelict cars, food scraps and old appliances.

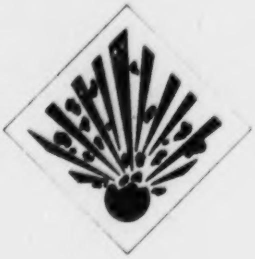
The amount of solid waste is constantly increasing. In Illinois, each person generates 1 1/3 tons of solid waste each year. Did you know that you alone generate about five pounds of solid waste each day? Americans produce about 165 million tons of municipal trash each year, according to the National Solid Waste Management Association. This figure is expected to increase as the population grows and per capita consumption rises.

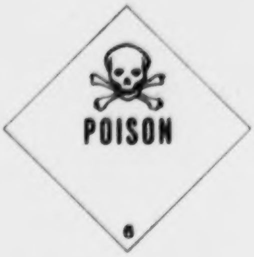
Hazardous Waste

As a consumer oriented society, our lifestyles demand the manufacture of goods which result in the production of hazardous waste. Hazardous waste includes certain industrial sludges; many chemical byproducts from manufacturing processes; used pesticide, herbicide, or germicide containers; and some incinerator ashes that contain toxic, heavy metals. To be classified as "hazardous," a waste must be ignitable, corrosive, reactive (explosive), or toxic.









About 10 to 15 percent of all wastes generated in the United States are hazardous. Often we feel that the only producers of hazardous waste are the large chemical companies. This isn't true. While the chemical companies do produce most of the hazardous waste generated annually by United States industries, other industries that produce such things as machinery, glass products, paper products and appliances contribute to the nation's hazardous waste.

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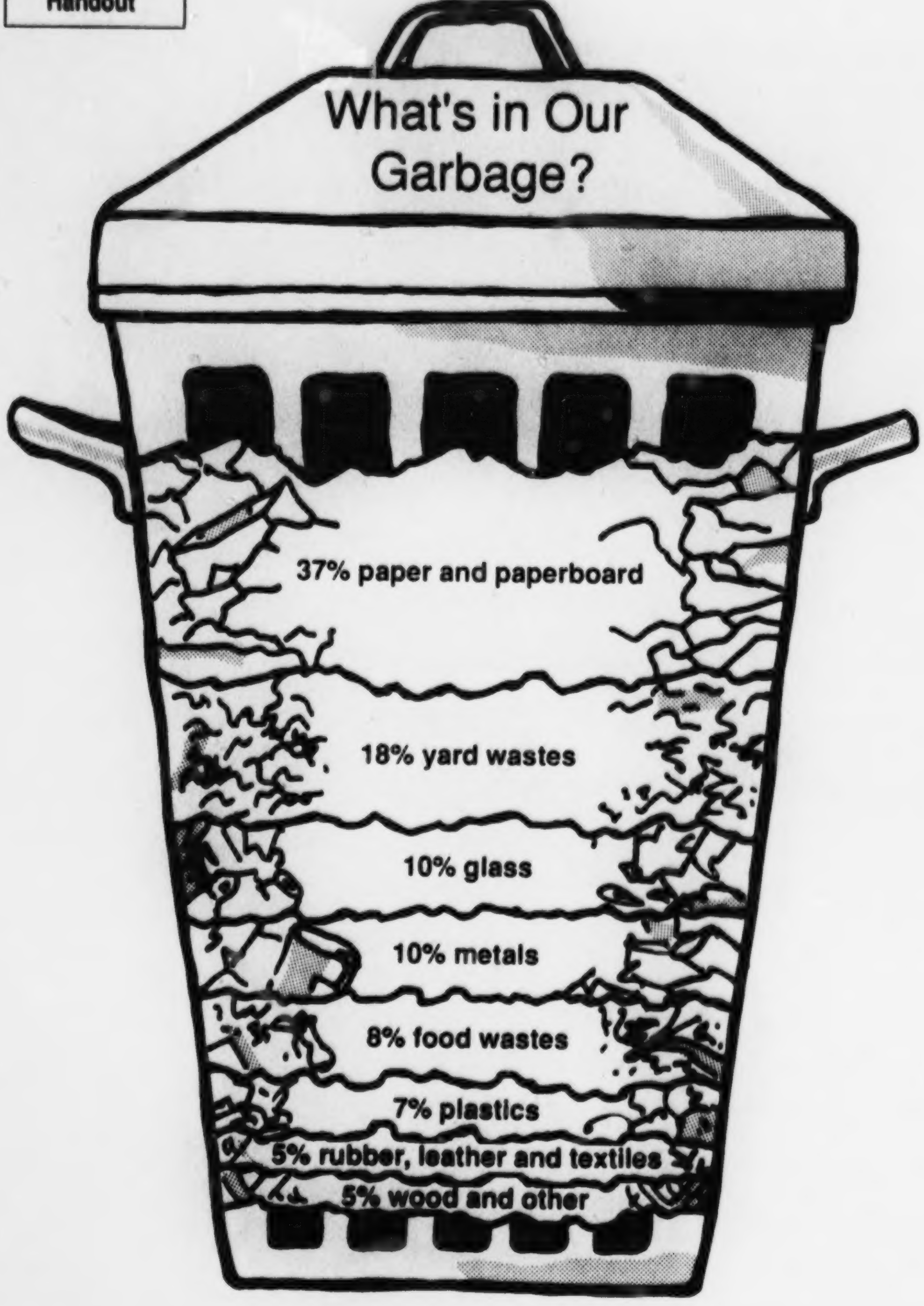
Handout

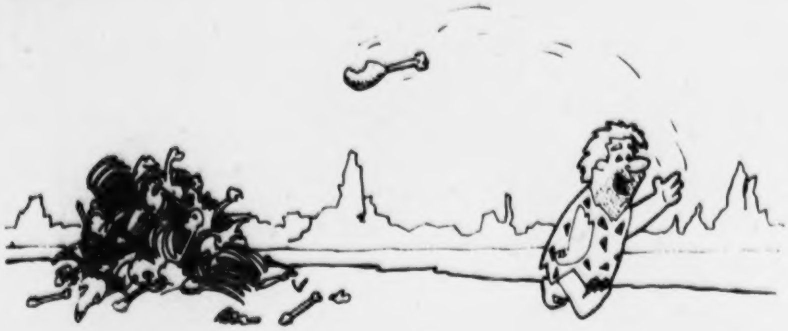


**Figures courtesy Franklin Associates, prepared for the U.S.EPA.*

THE HISTORY OF GARBAGE

Waste is nothing new.

Even cavemen had it. But when bands of nomads moved on to new hunting grounds, or food-gathering tribes left for new sites, they merely left their refuse behind.



Around 10,000 B.C., however, hunting and gathering activities began to decline, and agriculture became a way of life.

As human beings set up more permanent settlements, they began to need better methods for disposing of waste.

Still, according to environmental historian Dr. Martin V. Melosi, professor of history at the University of Houston, new ways came slowly.

In ancient Troy, he says, wastes were left on the floor of homes or simply thrown into the street.

There were, however, exceptions.

In the Indus Valley city of Majenjo-Daro, founded about 2500 B.C., central planning led to the construction of homes with trash bins and rubbish chutes. In addition, the city had a scavenger service and an effective drainage system.

Other Indian cities of that time, including Harappa, in the Punjab region, had houses with bathrooms and drains.

Archeologists who excavated ancient Babylon discovered sewage systems, cesspools and drains.

Apparently not everyone in the Egyptian city of Heracleopolis [founded about 2100 B.C.] got waste collection.

If, however, you were well-to-do, or lived in religious quarters, all your wastes were picked up, or, at least, that was the goal. Unfortunately, however, they usually ended up in the Nile River.

By 2100 B.C., Melosi reports, the homes of the Sea Kings in Crete had bathrooms connected to trunk sewers. By 1500 B.C., Cretan authorities had set aside certain areas for the disposal of organic wastes.

Chinese records from the second century B.C. show that forces of "sanitary police" took responsibility for collecting and removing dead animals and humans, while "traffic police" were responsible for sweeping the streets in the major cities.

To the City Council of Athens goes the honor of organizing the first municipal dumps in the Western world, about 500 B.C.

The municipal ordinance they passed - and enforced - required scavengers to dispose of waste at least one mile beyond city walls.

Historians say Athens wrote the first known law against throwing garbage into the streets.

In Rome, however, it was a different story.

Although the Romans had a public health administrator by the end of Augustus Caesar's reign in A.D. 14, it only collected wastes at events sponsored by the state, such as parades and games of the gladiators.

Independent scavengers collected garbage and resold it as fertilizer, while wealthy Romans used slaves to collect and dispose of waste.

Since Rome [at its height] had a population of more than one million, the waste problem was far bigger than the city could handle. Although the Romans had designed advanced water and sewer systems, most of the garbage was dumped in open pits at the edge of the city. These pits attracted insects and rodents.

As Melosi concludes, "Well before the fall of Rome, the city became incredibly unhealthy and dirty."

During the late Middle Ages (1000-1500 A.D.) in Europe, garbage disposal was even worse than it had been in Roman times. People simply dumped their garbage on the streets or in the river or harbor. Living conditions were unhealthy and many people died from plagues.

In the United States in the 1800s, many people who had lived in the country moved to cities to work. Getting rid of wastes such as household garbage, wood, manure and coal ash became a problem. Some cities hired people to take the trash to dumps on the edge of the city.

Other cities took the garbage composed of food waste to "swill yards." Farmers then took the "'swill" and fed it to their animals. Soon the animals died from eating the rotten garbage and people who ate the infected meat often became sick. The rest of the garbage was loaded onto barges called "garbage scows." The barges were pulled by tugboats into lakes, rivers and oceans and the garbage was then dumped into the water.

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Today, we know that if our waste is not properly managed, it will pollute the environment. However, our lifestyles encourage us to produce excessive amounts of trash. Our "throwaway" society produces 150 million tons of garbage and refuse every year. In Illinois, we throw away about 17.3 million tons of trash each year.

Most of this trash is buried in the ground for sanitation purposes. In order to reduce pollution to the environment, the majority of disposal sites are operated as "sanitary landfills" where waste is buried and trapped. However, sanitary landfills also pose a threat to groundwater which many people use as a source of drinking water. Another problem is that we produce more trash and garbage than we have landfill space to bury it. The IEPA predicts that in several years, at current rates of trash disposal, Illinois will use up all available, permitted landfill space. To replace this lost capacity, would require five new 60-acre landfills to be built every year. This is roughly equal to 295 football fields filled 100 feet high with trash and garbage.

To make us less dependent on landfills, the legislature enacted the Solid Waste Management Act. The law requires communities to evaluate and use landfill disposal alternatives. These alternatives include producing less garbage, reuse, recycling and incineration. Ideally, landfills should be used to dispose of only non-recyclable, non-burnable refuse.

Activity

TRASH CAN INVENTORY

INTRODUCTION: Materials which are discarded include paper, glass, plastics, steel, aluminum, cloth and other miscellaneous materials. An inventory of trash content can be taken to show how much of each of these materials is thrown away. This can be done as a classroom exercise, but classroom trash is relatively uninteresting because it generally consists only of paper. However, the paper could be accumulated for one to two weeks in boxes or other containers and then weighed. (You may need to speak to the building custodian to ensure that your "research project" is not mistaken for trash and discarded.) At the end of the period, the weight of waste paper generated can be determined. It is an interesting exercise to have students divide the total weight by the number of days to find the average weight of waste paper generated per day; or determine the amount of paper generated per student.

An alternative idea is to have two trash cans, using the other container for foodstuffs, gum, candy and used tissues. You can tell the students this is to protect them from dealing directly with harmful waste: i.e., germs.

OBJECT: This research project increases the students' awareness of what is being wasted, and reinforces the ideas that some of these materials may have value and should not be wasted.

ADVANCE PREPARATION: 1. Prepare a five day collection of trash bags full of classroom trash free of any unsafe materials and sharp edges so that students may handle the items. Make one bag per group of students.
2. Make copies of an inventory sheet for each student.

MATERIALS NEEDED:
1. Trash
2. Newspapers to spread trash on
3. Magnet to tell steel from aluminum

INSTRUCTIONS: Hand out an inventory sheet to each group. (*An example follows).* Explain that they are going to perform a research project to learn more about what is wasted. Hand each group a trash bag.

Spread the trash out, perhaps on an opened newspaper. Pick the items up one at a time and ask the student to identify what category it fits on the inventory sheet. Make a tally, or other counting mark in the appropriate place on the inventory sheet for each item, or separate into piles for counting.

It is important that each student understand how to identify each material category. Paper is a general term that includes printing and writing paper, tissues and toweling products, newspapers, cardboard boxes, tablet backs, paper sacks and other similar products.

The students may not be able to identify all materials found in the trash can. Instruct the students to count the items in each category.

When you are finished with the inventory sheets, you can discuss what items were found most often and least often. It is important to identify which items could have been recycled, and which items could have been reused. If aluminum or newspapers are found, these can be easily recycled.

FOLLOW-UP ACTIVITIES: 1) You may wish to have students compare weights and volume of trash and to make charts and graphs.

2) Encourage the students to take the completed inventory home and see if they can find items that they waste in their homes that can be recycled or reused. You could assign them to locate one such item and report on it to the class. They should learn to keep items that can be recovered or recycled separate from the other trash from their homes.

Worksheet

NAME____________________

TRASH CAN INVENTORY

In order to find out what kinds of materials we throw away, you are to find out what is in trash cans. Your teacher will provide a bag of trash for this research project.

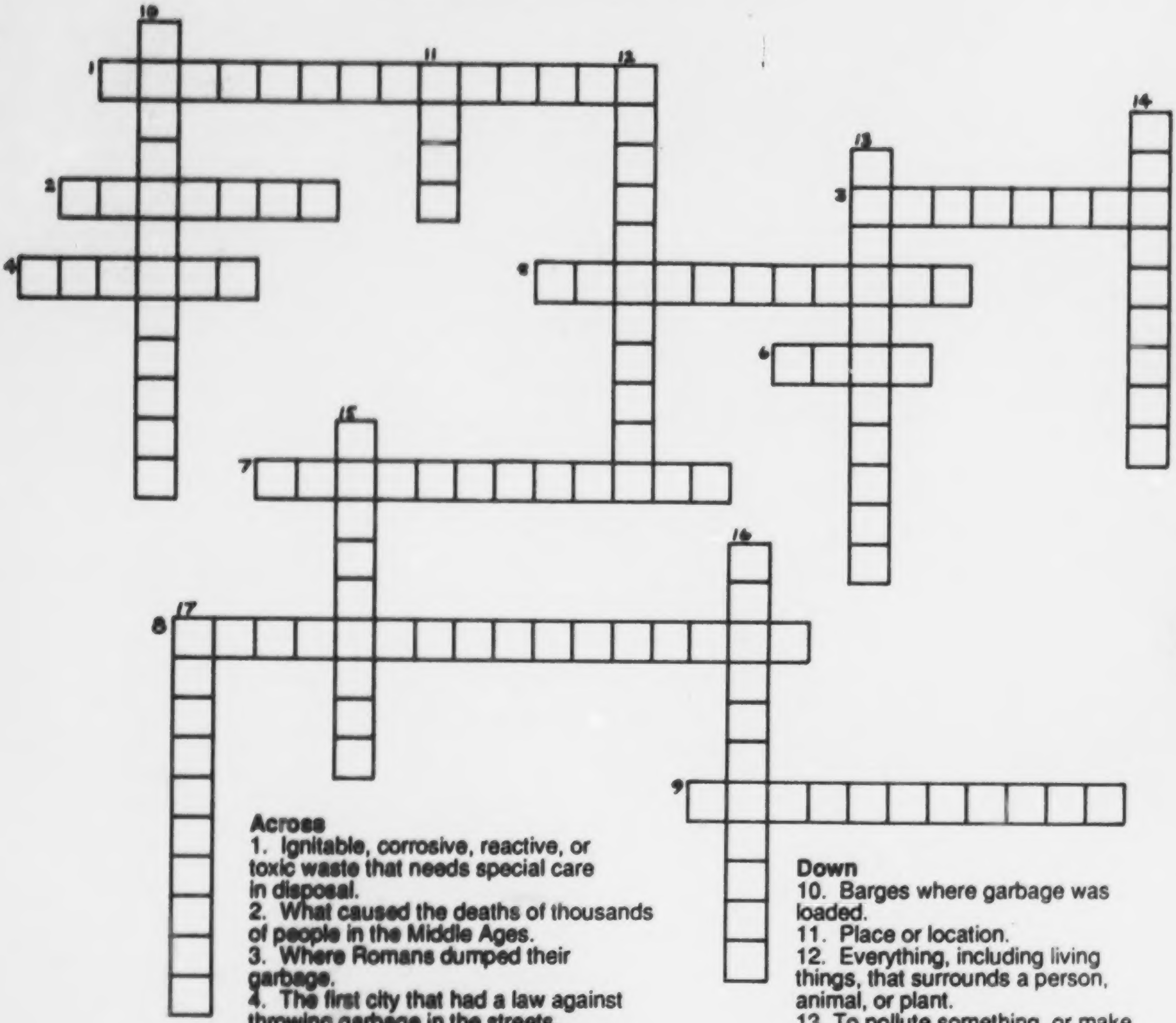
Spread out a newspaper next to the trash bag. Remove each item from the bag and place it on the newspaper. Decide which material each item is made of, and put each material in a separate pile. When finished, count the number of items in each pile and write the number in the space provided below. Decide which items are unnecessary waste. Which items can be recycled or reused? What can we do to reduce the amount of waste? When finished put the trash back into the bag.

MATERIAL	NUMBER OF ITEMS	CAN BE RECYCLED OR REUSED (YES/NO)
Paper		
Glass		
Steel		
Plastic		
Cloth		
Aluminum		
Other		

Activity

Name_______________

A Trash Trivia Crossword Puzzle



Across

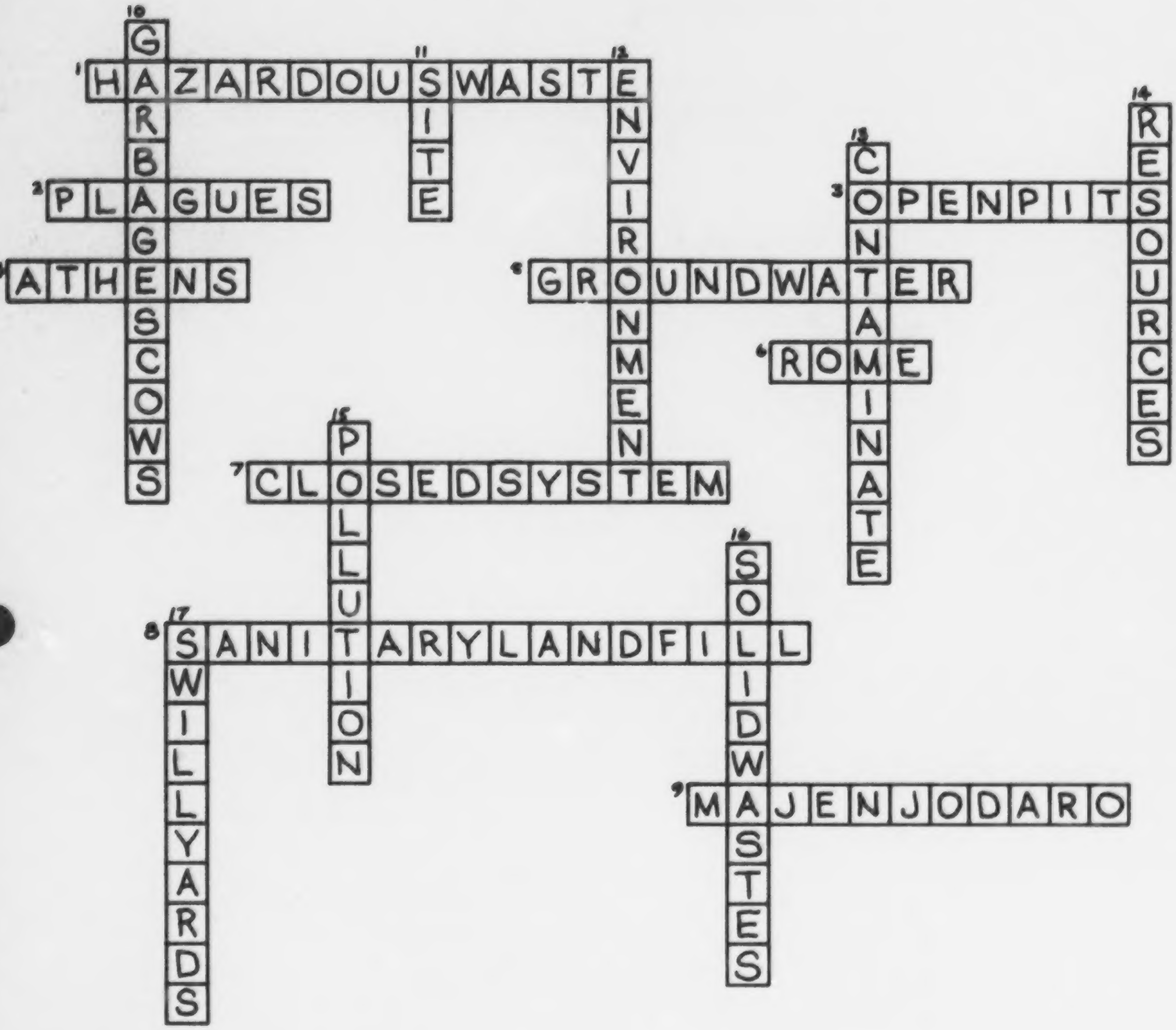
1. Ignitable, corrosive, reactive, or toxic waste that needs special care in disposal.
2. What caused the deaths of thousands of people in the Middle Ages.
3. Where Romans dumped their garbage.
4. The first city that had a law against throwing garbage in the streets.
5. The supply of water under the earth's surface that forms natural reservoirs.
6. This city had a public health administrator by A.D. 14.
7. A system such as a spaceship or Earth in which energy, but not matter, can be exchanged with surrounding space.
8. Site where garbage and trash are taken and covered daily with a layer of soil.
9. Homes in this ancient city had trash bins and rubbish chutes.

Down

10. Barges where garbage was loaded.
11. Place or location.
12. Everything, including living things, that surrounds a person, animal, or plant.
13. To pollute something, or make it dirty.
14. Air, water, soil, trees, plants, minerals, wildlife and other things that make up the natural wealth of the earth.
15. Whatever makes land, water and air dirty and unhealthy.
16. Trash and garbage without enough liquid to flow freely.
17. A place where cities took their garbage composed of food waste.

answer key

A Trash Trivia Crossword Puzzle


1 HAZARDOUSWASTE
2 PLAGUES
3 OPENPITS
4 ATHENS
5 GROUNDWATER
6 ROME
7 CLOSEDSYSTEM
8 SANITARYLANDFILL
9 MAJENJODARO
10 GARBAGESCOWS
11 SITE
12 ENVIRONMENT
13 CONTAMINATE
14 RESOURCES
15 POLLUTION
16 SOLIDWASTES
17 SWILLYARDS

Activity

OUT OF SIGHT, OUT OF MIND

GOAL: To help students visualize how much waste is generated for each person in Illinois and understand how the number of people living in our state and country affects this amount.

MATERIALS: 4.7 pound bag of miscellaneous trash (wash containers, avoid items with sharp edges)

PROCEDURE:

1. Describe trash and list some examples. Discuss:
   - ■ What qualities does an item have that makes you decide it is trash?
   - ■ What different kinds of trash are there?
2. Dump the 4.7 pound bag of trash on the floor. Discuss:
   - ■ Does this seem like a lot of trash? *This much trash is thrown out each day for every person in Illinois.*
   - ■ How do you think the number "4.7 pounds" was calculated? Who figured out this number? Will the number ever change? Why?
   - ■ How do you feel about the fact that you are responsible for 4.7 pounds of trash that is thrown out each day?
3. Calculate:
   - ■ Convert these numbers from pounds into tons. How many tons of trash do you make every week, month and year?
   - ■ To help you visualize how much a ton weighs, add the weights of students in the class until you reach one ton. How many students does it take to make a ton? How many "students-worth" of trash do you make every week, month and year?
   - ■ How many people are in your family? If 4.7 pounds of trash is generated each day for every person, how many pounds or tons of trash does your family make every week, month and year?
   - ■ How many people live in Illinois? How many pounds or tons of trash are generated each day in Illinois?
4. Discuss:
   - ■ What happens to all the trash you throw away?
   - ■ What do you think happens to waste at the landfill?
   - ■ What are possible problems with piling waste in landfills?
   - ■ What would you do with your family's trash if there were no truck that came to take it away? How might this affect the amount of trash your family makes?

5. Research the rate of human population growth in Illinois and the United States since 1650. Discuss:
   - What relationship might there be between an increasing human population and the amount of solid waste generated?
   - How might the amount of solid waste generated be influenced by changes in lifestyles since 1650?
   - How might the amount of solid waste generated be influenced by family income?
   - How have increases in numbers of people and amounts of solid waste affected the environment?
   - What are the predictions for future human population growth?
   - What predictions might you make for the amounts of solid waste in the future?
   - What impacts might an increasing population have on our use of natural resources?

6. Calculate:
   - If every person in Illinois threw away one less pound of trash per day, how much less trash would end up in our state's landfills?

7. Discuss:
   - What could you do to reduce the amount of waste you make?

***Pre- and Post-Activity Questions*:**

- *How many pounds of trash do you think are thrown out each day for every person in Illinois?*
- *What relationship, if any, is there between the number of people and the amount of trash?*

Activity

CLASS TRASH

GOAL: To have students calculate the amount and types of trash thrown out by their class at school and investigate where it is taken.

MATERIALS: Trash generated by your class on a typical day.

NOTE TO TEACHERS: *Students will need to be familiar with the concepts of weight, volume and number in order to do the following activity and understand its implications. Consider using this activity as part of a mathematics lesson that addresses these concepts.*

PROCEDURE:

1. List the items you throw in the classroom and lunchroom wastebaskets on a typical day. Now categorize them according to what material they are made of (e.g., food, paper, plastic, aluminum, glass). Predict what four types of materials make up the greatest portion of the waste by weight, volume, number of items. Record your predictions.

2. Collect and save the trash your class generates (in the classroom, artroom, shop, lunchroom, etc.) on a typical day (wash jars and cans, place food trash in a sealed container). You can save trash from more than one day, if you wish. This will enable you to calculate the average amount generated by your class each day.

3. Dump the trash on the floor. Sort items into piles according to the types of material of which the items are made.

4. Count the number of different items of each type (i.e., 47 pieces of paper, three aluminum soda cans, eight juice boxes, 11 plastic bags, one broken pencil.) *What types of items comprise most of the trash by number?* Draw a bar graph to illustrate this. Place the trash types in separate bags.

5. Select the four types of items you estimate make up most of the trash by weight. Use one of the following methods to determine the exact or approximate weight of each type:
   a) If you have a grocery scale in your classroom, weigh the items.
   b) If you have a bathroom scale:
      - Stand on the scale. Example:
        What is your weight?. . . . . .100 lbs.

- Pick up a bag.
  Now what is your weight?. . . .102 lbs.
- How much does the bag weigh?. . 2 lbs.

c) If you don't have a scale, find objects in the classroom that are of a known weight. Compare the weights of your object and the trash (use a balance if you have one). Estimate the weight of the trash.

6. Calculate the volume of trash in each bag by measuring the width, length and depth of items in it. *How might volume differ if the glass, cans or boxes are crushed? Does weight change if volume changes?*

7. *How do your calculations compare with the predictions you made in Step 1?*

8. *How much trash does your class throw out in a day, week, month and school year by weight, volume and number?* Calculate the average amount each student throws out in one day.

9. *How much space will one school year's-worth of your class's garbage fill if the garbage is not compressed?* Calculate the volume of your classroom. *If you didn't remove any of your class's trash from the classroom, how much of the room would be filled with trash by the end of the year? How much room would be left for you?*

10. If the number of students in your class is average for your school, calculate how much trash your school generates each school year.
Discuss:

- *Do you think you class makes a lot of trash? Not so much?* Explain your response.
- *When the trash from each class in your school is added together, do you end up with a lot of trash?* Explain reasons for your response.

11. Investigate where your school's trash is taken.

Pre- and Post-Activity Questions:

- *How much trash do you think your class throws away each day?*
- *What types of trash do you think your class throws away on a typical day?*
- *What happens to your school's trash?*

MODULE 3: Solid Waste/Litter

Student Resources	*Waste Management -- A Problem for All of Us! (Text)* *A Good Way to Get Rid of Trash and Garbage (Text)* *What is Litter? (Text)* *Sanitary Landfill (Handout)*
Classroom Materials	*Meet the Family Next Door. (Poster)*
Activities	*The Litterbug (Fold-in)* *Making a Mini-Landfill (Experiment)* *The Cost of a Toss (Role playing)* *Landfill Leachate (Experiment)* *Make Trash Live Again (Bulletin board)* *Start a Litter Campaign (Project)* *Learning to See Litter (Project)* *Taking Pictures for Your Litter Campaign (Project)* *Write Letters for a Litter Campaign (Project)*

3

WASTE MANAGEMENT -- A PROBLEM FOR ALL OF US

Urban waste management -- that's a problem, all right. But someone else's. Not mine.

That's the first reaction most of us have.

And yet, have you counted the garbage bags and trash cans you and your family put out every collection day?

If you're like most of us, your daily garbage includes such diverse items as food scraps, junk mail, newspapers and magazines, a used piece of aluminum foil, wrappers from candy and fast food items, a plastic soft-drink or milk bottle, a tin can or two with food still clinging to the sides, the glass jelly jar, plastic margarine tub, or cardboard butter box and a hundred or more other items you never expect to bother with again.

Not to mention the waste you yourself generate at school.

At school: computer paper, with torn-off edges. Pencil-sharpening dust. Typewriter and printer ribbons. The sandwich wrapper and cookie crumbs left over from your brown-bag lunch. Or the disposable forks, knives, dishes and paper napkins from the school cafeteria. The apple core. The banana peel.

PQRSTUVWXYZ

The average list goes on and on.

Add to it millions of pounds of industrial and medical waste, some of it hazardous, and you begin to see the magnitude of the problem.

Last year, by estimates from "Waste Age," the industry's trade magazine, the United States threw away a staggering 170 million tons of refuse.

That's the equivalent of 3 1/3 to 4 pounds of collected residential wastes per person per day, plus commercial, industrial, institutional and agricultural wastes.

The average American has generated two tons of food wastes by the time he or she is 18 years old, five tons of food wastes by age 45 and eight tons of food wastes within his or her average life expectancy.

As a group, Americans throw away 1.6 billion pens, 2 billion razors and blades and 16 billion diapers each year. These are just examples of disposable products we throw away each day, helping to create tons of wastes.

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A GOOD WAY TO GET RID OF TRASH AND GARBAGE

"Solid waste" generally refers to the paper, aluminum cans, glass jars, plastic bottles, spoiled food, broken TV sets, old stoves, junk cars and other trash and garbage that people throw away. Every year in the U.S., garbage trucks collect about 132 million tons of solid waste! What should we do with all of it?

If we toss the stuff away carelessly, it litters streets, highways, the countryside and waterways.

If we burn it in the open, it pollutes the air.

If we leave it in the open at garbage dumps, it smells, looks ugly and attracts rats and insects.

If we bury it, we lose the value of materials in it that might be recycled.

Sanitary Landfill

Open garbage dumps have been made better by turning them into sanitary landfills. Today's landfills include multiple safeguards to contain wastes and isolate them from surrounding water and soil. In many cases, for example, such safeguards involve a protective liner to prevent filtration. These liners may be made of compacted clay or impermeable materials such as plastic. When clay is used, the layer may be as much as 10 feet thick.

Drainage systems are another common feature. Instead of allowing rainwater and other liquids to collect inside the liner, these "leachates" pass through the refuse and are pumped to the surface where they are treated and discharged.

Each day, landfill operators must handle truckloads of trash. To assure proper management, such wastes are generally unloaded at only one designated area. This area is known as the "working face."

Once trash has been deposited, it is spread and crushed by a bulldozer or compactor. As each day ends, the waste is covered with a layer of soil to minimize odors and discourage insects and rodents. Monitoring wells allow technicians to check groundwater quality and detect contamination.

When landfills reach their capacity, they are sealed and covered with a cap of clay and dirt. Depending upon their location, they may be turned into parks, gardens, golf courses, playgrounds, or even ski and sledding areas. Environmental monitoring continues long after these facilities have been converted to other uses.

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WHAT IS LITTER?

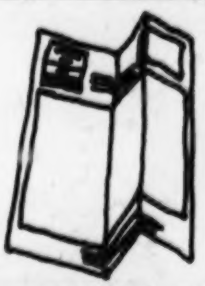
Litter can be found all over. It is often seen along roadways, in forests and streams and in parks and streets. Two percent of the country's solid waste ends up as litter. The only cause of litter is careless people. Tossing something out of a car window or on the street is a bad habit. Luckily, we can change our attitude and habits and stop littering which will help reduce the amount of garbage we see lying around.

Litter is land pollution. It is an ugly contamination of natural areas and a threat to wildlife, plants and humans. Litter can also be a breeding place for rats, insects and disease-carrying pests. Some types of litter can cause fires.

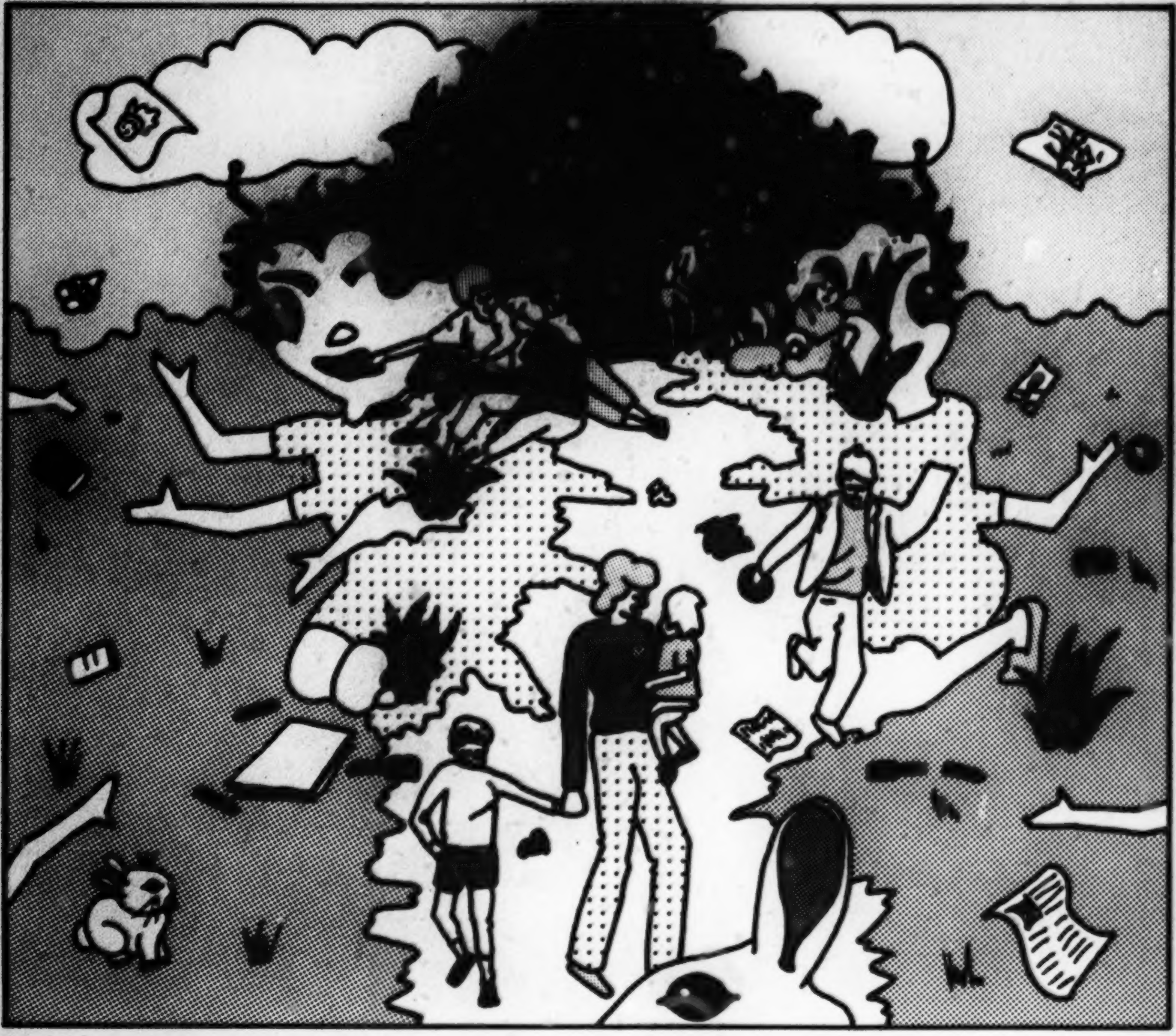
Litter also costs us money. Sanitation crews hired by the state or local governmental agencies are paid with taxpayers' money to clean up litter. In 1987, the Illinois Department of Transportation spent $5.3 million to clean up litter along our state highways.

WHAT GROSS FORM OF USELESS ANIMAL LIFE IS TRASHING OUR COUNTRYSIDE?

A threat to our well-being has established itself in our midst. To find out what this menace is, fold in page as shown in diagram on right.



A➤ FOLD THIS SECTION OVER LEFT ◄B FOLD BACK SO 'A' MEETS 'B'



THOUGH BUSY PEOPLE RUSHING ABOUT OFTEN FAIL TO NOTICE LITTLE BITS AND SCRAPS OF NASTY DEBRIS WHICH THEY SCATTER-BEFORE LONG, THERE'S ENOUGH MESS TO FILL A GARBAGE TUG MAKING THE WORLD AROUND US MESSY FOR EVERYONE!

A➤ ◄B

Experiment

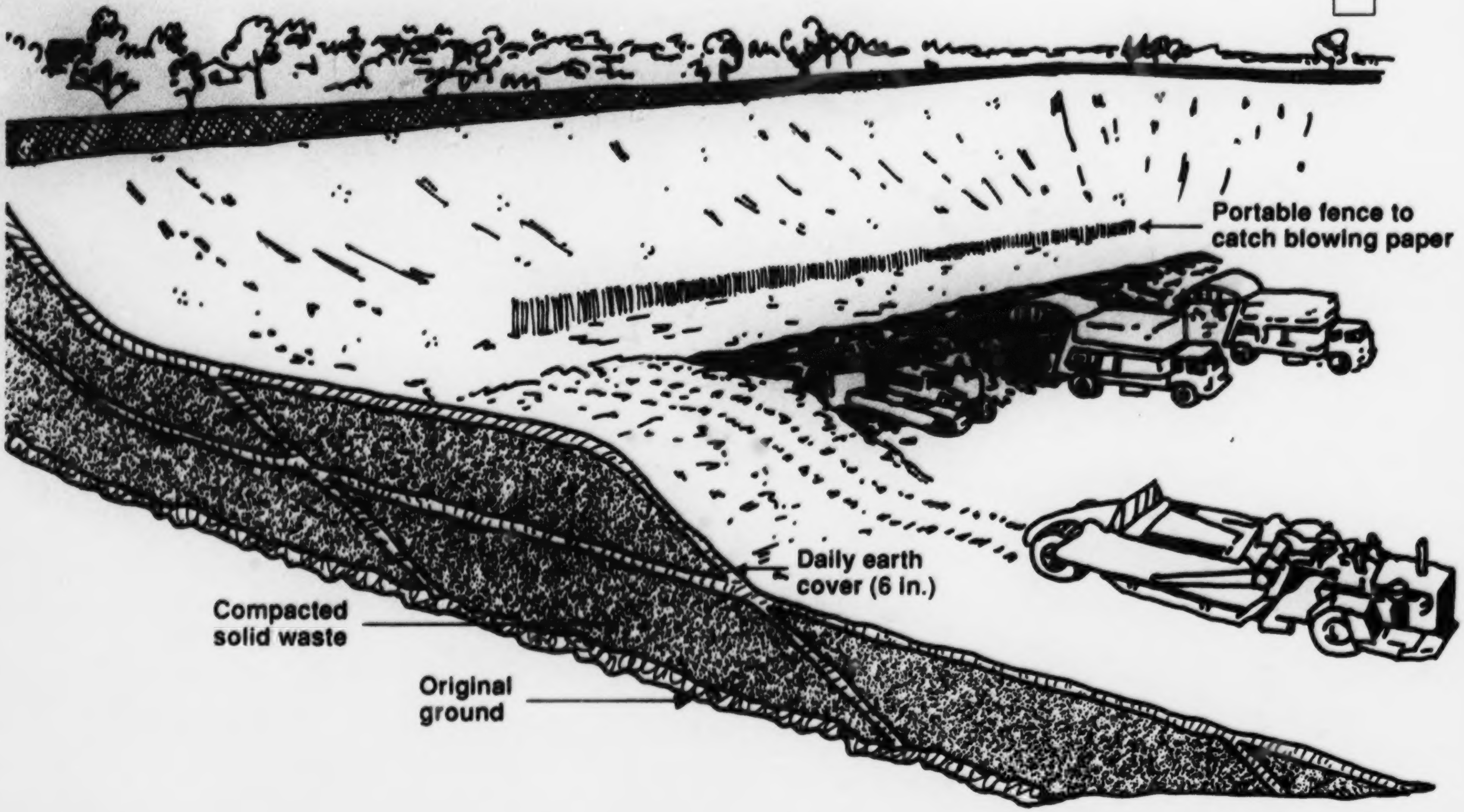
MAKING A MINI-LANDFILL

GOAL: To have students examine the materials that comprise the products they use, describe whether these materials are renewable or nonrenewable resources, observe what happens to materials when placed in a landfill and decide whether they should be disposed of in a different way.

MATERIALS: A large clear glass jar, soil, a piece of fruit or vegetable, small piece of plastic, a piece of paper, a piece of aluminum, crayons, masking tape.

PROCEDURE: Place some soil in the bottom of the container. On top of the soil, place the piece of fruit and the piece of plastic. (You can add other things too, like a small piece of aluminum foil or a small piece of paper.) Add more soil on top of these items. Put the container in a warm place, and keep the soil damp. After one week and again after another week, check to see what has happened to the fruit and the plastic and any other items you buried in the soil. Does the fruit look different than it did when you buried it? Does the plastic look different? Some things come apart, or decompose, in the environment. Other things persist, or last for a long time. Which do you think is more harmful to the environment?

SANITARY LANDFILL


Portable fence to catch blowing paper
Daily earth cover (6 in.)
Compacted solid waste
Original ground

Experiment

LANDFILL LEACHATE

BACKGROUND: At the landfill it is the rainwater, and any liquids in the waste, that leach through the soil. Soluble toxic or hazardous materials can be washed down with them. The leachate will go down through the soil until it reaches an impermeable layer (a layer it cannot go through), or it will flow down hill over the surface. Thus, there is a potential for contamination of groundwater or waterways.

MATERIALS: Coffee grounds, water, coffee pot.

PROCEDURE: Pour hot water over coffee grounds. The first bit of water is absorbed. As the grounds get saturated, the water leaches through the grounds, and what you collect in your coffee pot is leachate. So leachate is partly water and partly the chemicals it has picked up on the way.

Role Playing

THE COST OF THE TOSS

GOAL: To have students develop a better understanding of what options exist for managing solid waste, and the costs of benefits of each option.

PROCEDURE:

1) Imagine yourself as the mayor of Beautiful, Illinois. Yours is a pleasant city of 65,000 people. Unfortunately, Beautiful is in the midst of a not-so-wonderful crisis: your landfill must be closed because it doesn't comply with current standards for protecting the environment. What is Beautiful going to do with all its garbage?

As the mayor, you are responsible for investigating new options for managing Beautiful's solid waste. You begin by forming a solid waste committee to study the options. Who do you think should sit on their committee (town treasurer, public works director, citizen representative, landfill developer, etc.)? Assign fellow classmates to play these roles and decide on a name for your committee.

2) Call a meeting of the committee. Your assistant has prepared the chart, "Managing Garbage From Homes," to help members see some options and impacts of managing garbage from Beautiful's homes. Study the chart and, as a group, consider the following questions:

- At first glance, which waste disposal option seems best? Why? Do you all agree? Is there one best option?
- What criteria and values are you using to judge options? Are you pro-business, pro-taxpayer, pro-environment, pro-convenience? Discuss how your personal points of view might influence how you judge the importance of each potential impact.
- For how many years into the future are you planning? Why is this an important consideration (population growth, long-term economic and environmental impacts, etc.)?
- How big is 52,000 cubic yards? How much space will you need if you choose to landfill Beautiful's garbage for that many years?
- Compare the pros and cons of citizen convenience and environmental impacts for each option. Do you consider citizen convenience more important than environmental impacts or vice verse? Why? How does your view affect which option you think is better?
- What is the relationship between net cost and citizen convenience? Is what is convenient the least/ most expensive? If saving money is your

main concern, which option would you choose? Should saving money be your only concern?

- Does this chart calculate in the "costs" of each option's long-term environmental impacts or use of natural resources? What might these costs be? How much should your committee be concerned about these "costs" in making your decision? How easy is it to put a dollar value on environmental damage?
- If creating jobs is high on your list of priorities, which option would you choose? What do you think about the often-made statement that recycling eliminates jobs?
- You have read somewhere about composting municipal solid waste. Where can you find out more about composting? Why might your community consider composting as a valid option for waste disposal? Which wastes could be composted?
- What are the pros and cons of incineration? Do you think the benefits (landfill space saved, energy produced, convenience) outweigh the costs (landfill still necessary, toxic ash and air pollutants produced, expensive)? What are the experiences of other communities that already have installed incinerators? How do the pros and cons of incineration compare with those of recycling?
- Recycling newsprint sounds like a great way to save landfill space and trees. But you've heard that some newspapers use ink that contains lead, a hazardous metal. What happens to this lead when the paper is landfilled, recycled, composted, burned? What have newspaper manufacturers substituted for lead inks?

3. Investigate what is required by your local, state and federal governments for chosing the waste management options for Beautiful (i.e., public hearing, citizen referendum, IEPA approval).

4. Do you feel you have enough information to make a wise decision for your town? If not, where can you find this information?

5. Now that your committee has investigated and discussed the options for Beautiful's solid waste management plan, make a decision about which option(s) the town should enact.

6. List suggestions for what you can do to ensure the success of Beautiful's new waste management plan (i.e., community education, providing containers for recycling).

Bulletin Board

MAKE TRASH LIVE AGAIN

BACKGROUND: The modern home is one of the main sources of solid waste. It is a good place to begin solving the problem of how to reduce the amount of waste generated. This can be done by conservation and re-use.

MATERIALS: Poster paper, glue, tacks, scissors.

GOAL: Make a home bulletin board to show how many items could have a second life or other use. Examples of materials which may have a second use are plastic containers, milk cartons, metal cans and bottles.

Project

START A LITTER CAMPAIGN

GOAL: A litter campaign to prevent and reduce litter in a particular area is a good way to bring public attention to the litter problem.

MATERIALS: Town map, poster paper, litter containers.

PROCEDURE:

1. Find a place to make a litter survey. (See Litter Survey material.)

2. Make posters for the campaign.

3. Talk about and select ways to appeal to children younger than yourself, older students and adults such as clubs, businesses and public agencies.

4. Make a large wall sketch or charts to show all of the different phases of your litter campaign and who or what groups will carry them out.

5. Choose a good name or slogan for your campaign.

6. To have an effective campaign against litter in your town you will need many groups working together.

One or more groups will be needed to:

- clean up selected areas with much litter
- set up posters
- continue publicity in newspapers or on local radio about the progress or success of the anti-litter campaign
- obtain and set out more litter containers in places where there are not enough, such as recreational areas and ball fields
- make sure that the additional litter containers are emptied regularly.

7. Write down all the reasons why your group wants to have an anti-litter campaign.

Project

LEARNING TO SEE LITTER (Litter Survey)

GOAL: Litter is all around us. People are not always aware of the litter until they stop and look for it. Litter that is not biodegradable and cannot be decomposed will last much longer in the environment than biodegradable litter.

PROCEDURE:

1. Survey one of the following: School, neighborhood, your yard, part of your town. Try to pick an area with a lot of litter.

2. Use the Litter Survey Chart to record the location and the kinds of litter you found.

3. After identifying and categorizing the types of litter you found on your chart, look for signs of decomposition, if any.

4. Have the class discuss the possibilities of cleaning up one of the areas. Photograph the area before and after it has been cleaned up. (See Taking Pictures of Your Litter Campaign.)

5. After the class has completed the chart, discuss the following questions.

   A. Why is one type of litter found more often than others?
   B. Were most of the litter items you found biodegradable? To decide whether a litter material is biodegradable you may look at old litter which is partly decomposed outdoors, such as old newspaper or cardboard, rusted steel cans (a small magnet will stick to steel cans), sunlight rotted plastic (especially white plastic bottles), polyvinyl chlorides (PVCs). Get a list of biodegradable substances.
   C. Make a list of different reasons why you think people litter.
   D. What is the source of each litter item? (Where was it purchased?)
   E. Was it thrown from a car or dropped by someone walking?

6. Have the students write a paragraph to show how they feel about a littered place.

Project

TAKING PICTURES FOR YOUR LITTER CAMPAIGN

BACKGROUND: In today's society, many people have the idea "out of sight, out of mind." Through inexpensive modem photography, litter problems can be brought to the attention of many people. This publicity may inspire involvement from people who can help the campaign.

YOUR JOB IS: Photograph a littered area before and after a litter campaign and clean up.

BEGIN HERE: Along with a litter campaign and letter writing efforts, pictures of your litter survey sites will add to your effort by making citizens and community leaders aware of the problems.

HERE ARE SOME IDEAS:

1. Photos of unsightly, illegal nearby dumpsites may be compared to those of a well managed landfill.

2. Photos of a littered lot may be compared to a clean field.

3. Candid photos of the rear of stores and industries could make owners aware and prompt them to clean up.

4. Before and after photos of the litter site surveyed can illustrate your litter clean up efforts.

NEXT: After you have finished taking your photographs, pin them up on the classroom bulletin board. Write captions underneath them to tell what they describe and what actions were taken, if any.

Project

WRITE LETTERS FOR A LITTER CAMPAIGN

BACKGROUND: The pen is mightier than the sword. Well written letters sent to the right places often get dramatic results and responses. Letters are also necessary to maintain good communication between social groups or individual people.

BEGIN HERE: Divide into three groups.

Group 1 - Write to the editors of your school newspaper, the P.T.A. bulletin and daily or weekly newspapers in the area.

Group 2 - Write letters to government officials such as the mayor, state legislators and the governor.

Group 3 - Send letters to local sanitation and health officials requesting their advice and aid in hauling the litter you have gathered to a suitable disposal site.

Topics to Discuss in Your Letters:

1. Purpose of your litter campaign.
2. Location of your litter survey.
3. Advice or support on materials you require from them.
4. Enclose pictures to document your campaign if possible.

✎ Keep copies of each letter you send and of the dates they were sent on. Record all responses.

MODULE 4: Hazardous Waste

Student Resources	*Solving the Hazardous Waste Puzzle (Text)* *Hazardous Waste Sources (Handout)*
Classroom Materials	*Hazards of Household Products/ Know Your Chemicals (Poster)*
Activities	*Hazardous Waste Emergency Plan Simulation (Role Playing)* *Common Household Hazardous Wastes (Worksheet)* *Is Hazardous Waste Generated From the Manufacturing of a Bicycle? (Activity)* *Micro-ponds (Experiment)* *Hazardous Waste Intelligence Quotient Quiz (Activity)*

4

SOLVING THE HAZARDOUS WASTE PUZZLE

What Is Hazardous Waste?

Hazardous waste can be a solid, liquid, or gas. It is a waste material which may be harmful to human beings or the environment when not handled property.

Hazardous waste has certain characteristics that make it potentially harmful. It may be toxic, corrosive, ignitable, or explosive.

Because of these potential dangers, hazardous waste requires special care when being stored, transported, or disposed of.

Where Does It Come From?

Manufacturers use many chemicals to create their products. The waste material, or what's left over when the desired item is completed, can be hazardous.

The production of all sorts of things - from medicines to tennis shoes - can generate hazardous waste. Putting the colors in paints and fabrics generates hazardous waste. So does the manufacture of many metal, plastic and even wood products.

Hazardous waste is generated by big industries like automobile and computer manufacturers and by small businesses like your neighborhood cleaners or photo shops. About 10 to 15 percent of all wastes generated in the United States are hazardous.

Many of our favorite activities depend on products which created hazardous waste while being manufactured. Our demand for these products plays a part in the production of hazardous waste.

Can We Stop Producing Hazardous Waste?

No.

We can reduce quantities through careful management.

But the fact is that production of telephones, television sets, computers, cars, bicycles and countless other items that we use every day generates waste material. Some of these wastes are hazardous.

A study done in 1985 by the Congressional Budget Office shows that while it is possible to reduce the volume of hazardous waste in manufacturing, it is not possible to eliminate it entirely, because of our continued demand for goods.

Hazardous wastes are created by our modern lifestyle. Since we enjoy the benefits of the 20th century, we must learn to deal with the challenges that go along with it.

Fortunately, 20th century solutions are available.

We've Got the Problem, How Do We Handle It?

With proper management, we can take the hazard out of hazardous waste.

Hazardous waste can be safely managed while we enjoy the benefits of modern industry. When managed properly, 'hazardous' waste will not be a hazard.

And ways to do this already exist.

Methods of Dealing With Hazardous Waste.

A variety of techniques exist for the safe management of hazardous waste.

Reduction. Some industrial processes can be changed to reduce the volume of hazardous waste.

Recycling. Some hazardous wastes can be reused, either in industrial processes or as useful products.

Incineration. Burning at high temperatures destroys some hazardous wastes.

Chemical treatment. Certain wastes can be made less hazardous by the application of standard chemical processes.

Biological treatment. This treatment employs micro-organisms which consume the waste material.

Land disposal. Residues from the above techniques and materials which cannot be treated by any other method can be safely isolated from the environment by containment in the land.

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Handout

HAZARDOUS WASTE SOURCES

The products we use	***create these hazardous wastes***
PLASTICS	Organic Chlorine Compounds
PESTICIDES	Organic Chlorine Compounds Organic Phosphate Compounds
MEDICINES	Organic Solvents Heavy Metals
PAINTS	Heavy Metals Organic Residues Pigments Solvents
PETROLEUM PRODUCTS	Oil Phenol Heavy Metals Ammonia Salts Acids Caustics
METALS	Heavy Metals Flouride Cyanide Acids Solvents
LEATHER	Heavy Metals Organic Solvents
TEXTILES	Heavy Metals Dyes Organic Chlorine Compounds

Worksheet

COMMON HOUSEHOLD HAZARDOUS WASTES

Many of the items we use every day can become hazardous wastes if they are disposed of improperly. Hazardous wastes can be classified as being ignitable if they can catch on fire and burn; corrosive if they eat away the containers which hold them; reactive if they can explode; and toxic if they are poisonous. Of course, some wastes can be in more than one category. For example, fingernail polish remover is both ignitable and toxic.

DIRECTIONS: Place an **I** if the object is an ignitable, **C** if it is corrosive, **R** if it is reactive, or **T** if it is toxic. Some items may have more than one letter. Some items have no letters.

______ 1. transistor battery
______ 2. car battery
______ 3. shaving cream can
______ 4. used motor oil
______ 5. empty spray paint can
______ 6. drain cleaner
______ 7. empty insecticide spray can
______ 8. unused matches
______ 9. used match
______ 10. unused drugs and medications
______ 11. unused fertilizer
______ 12. broken thermometer (silver colored only)
______ 13. rug spot remover
______ 14. lacquer
______ 15. flea killer collar for pets
______ 16. newspaper
______ 17. paper
______ 18. used spray deodorant can
______ 19. hydrochloric acid from school lab
______ 20. flashlight battery

Worksheet Answer Key

COMMON HOUSEHOLD HAZARDOUS WASTES

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C,T	1.	transistor battery
C,T	2.	car battery
R	3.	shaving cream can
T,I	4.	used motor oil
R	5.	empty spray paint can
C,T	6.	drain cleaner
R,T	7.	empty insecticide spray can
R,I	8.	unused matches
I	9.	used match
T	10.	unused drugs and medications
R,T,I	11.	unused fertilizer
T	12.	broken thermometer (silver colored only)
T	13.	rug spot remover
I,T	14.	lacquer
T	15.	flea killer collar for pets
T	16.	newspaper
	17.	paper
R	18.	used spray deodorant can
C,T	19.	hydrochloric acid from school lab
C,T	20.	flashlight battery

Activity

Is Hazardous Waste Generated from the Manufacturing of a Bicycle?

INSTRUCTIONS: List the parts on a bicycle. Was hazardous waste generated when making the parts for the bicycle? Did manufacturing of all the parts cause hazardous waste to be generated, or just some of the parts? What parts caused hazardous waste to be generated?

Activity - Teacher's Key

Hazardous Waste Generated in the Manufacturing of a Bicycle

Chrome parts - - handlebars
frame
wheel rims

Spent pickle liquor is generated from steel finishing. This process removes scale, oxides and other impurities from metal surfaces through immersion in an inorganic acid. This acid becomes polluted with heavy metals such as lead, cadmium and chrome. This waste is extremely toxic.

Paint

Paint sludges and solvents contain heavy metals. Paint which is not used or is not suitable for painting your bicycle becomes a waste. Paint thinners contain flammable solvents and are hazardous.

Seat, hand grips, streamers

Organic compounds known as "plasticizers" are used to make plastic tough and flexible. Individual chemical compounds known as "monomers" are combined to make "polymers." Polymers combined with other ingredients are used to make plastics. These compounds can be hazardous or toxic when discarded into the environment.

Chain oil, grease for bearings in the wheels

Bicycle lubricants are manufactured by refining petroleum. This process generates hazardous sludges and volatile compounds.

Rubber for tires

Sulfur and other additives are vulcanized in the manufacture of tires. This process produces volatile compounds and carbon black, and also produces Polycyclic Aromatic (PAHs) which contain known carcinogens.

Role playing

HAZARDOUS WASTE EMERGENCY PLAN SIMULATION

DIRECTIONS: Divide the class into teams with four to five members on each team. Each team is given the information provided and asked to devise an emergency management plan. A minimum of one class period should be allowed for formulating the plan. During the next class period, each team should present its plan. After all plans have been presented, teams should discuss with each other the advantages and disadvantages of each plan.

TROUBLE IN FLOWER HILL

The Site

The mythical town of Flower Hill, Ill, is a small community of about 3,000 citizens. Flower Hill is located about 20 miles from a large city. Many of the citizens work in the city, although a few operate small farms nearby. A 50-acre lake north of town (Flower Hill Lake) provides boating, fishing and swimming opportunities. It also is the city's source of drinking water. The beautiful countryside and lake have attracted many workers from the city and, as a result, the town is growing.

The Discovery

As Flower Hill continues to grow, the Adams Construction Company has purchased the old Flower farm near Flower Hill Lake with the intention of building Lakeview Acres, a new subdivision. When the bulldozers began excavation, they uncovered some old barrels, broken glass and metal scraps. A closer examination revealed that the metal was from an old car and that the glass was similar to that used by chemical companies to store solvents. Most interesting were the barrels. Some of the barrels were intact and contained used motor oil. Others were rusted through, most having no labels indicating what the contents had been. One of the broken barrels had a label that indicated the barrel had once contained DIRAZAZINE, an extremely carcinogenic (cancer causing) chemical. When the barrels were discovered by the Adams Construction Company, excavation ceased and the proper officials were called.

The Geology

The Flower farm is located on rich farmland. Under about 15 feet of topsoil, subsoil and rock is a layer of Grainy Sandstone. The Grainy Sandstone is about 50 feet thick and is very porous. Water travels through it readily. Below the Grainy Sandstone is the Fairview Sandstone, which also is extremely porous. Often there is a layer of Madison Shale between the two. The Madison Shale is impervious to water, although it often has "holes" in it that would allow water to move through the shale. A 10-foot-deep sample well, located between the drums and the lake, revealed Dirazazine.

The Problem

If the Dirazazine gets into Flower Hill Lake, it will get into the town's water supply and many people will be exposed to a dangerous carcinogen. But there is some question as to whether the Dirazazine is moving toward the lake and if so, at what rate. The Swainson's deep well in the Fairview Sandstone has shown no contamination. The citizens have heard rumors about how dangerous Dirazazine is and are afraid to drink the water, swim in the lake, or eat fish from the lake. Many of the residents can be best described as "panicky." Mr. Swainson remembers about 10 years ago when some "city slickers" gave him $20 to dump some "junk" on his farm. He doesn't remember their names or what company they were from. There are no records of who was responsible for the dumping.

HAZARDOUS WASTE EMERGENCY PLAN SIMULATION

SOLUTIONS

In Illinois, we have a state Superfund program that provides the type of help necessary to clean up these types of problems. There are no perfect solutions available for this type of environmental problem; however, experts usually would suggest actions similar to those outlined below.

I. Site Investigation - Various alternatives are available to officials to help define the problem and determine how significant it is.

A. Waste samples should be taken to help determine what hazardous wastes are present. During this activity, any buried containers found should be labeled or numbered so determinations may be made concerning how to handle each container of material.

B. Soil samples should be taken from the area around the containers. This analysis should help determine whether a large amount of material has leaked from the buried containers. In addition, at abandoned sites such as these, sometimes liquid wastes are placed into pits in the earth in addition to the materials placed in containers.

C. Water samples can be taken from lakes as well as the surrounding wells to determine whether hazardous wastes have migrated into the drinking water supply at potentially harmful levels.

II. Emergency Actions

A. Emergency removal of buried containers or of soil with high concentrations of hazardous wastes or substances may be necessary based upon results from samples taken in step I(A) or I(B). It also may be necessary to control site access through the installation of appropriate security methods such as fencing, signs, or even a guard.

B. Water supply. Based upon analysis of samples taken in I(C), it may be necessary to issue an alert to water users concerning any contaminants present, or for levels of contamination that are above safe levels; it may even be necessary to provide an alternative source of drinking water. Even if the water in the lake tests as clean, with no indication of contamination, it is very important to somehow get that information out to the public to dispel fears concerning whether the water is safe.

III. Public Information

A. In any situation involving hazardous waste, it is very important to establish procedures to release information to the public so everyone may be aware of facts available. The very worst situation is one where information is not made available to everyone.

IV. Precautionary Measures

A. Long-term measures. If preliminary investigation shows the presence of hazardous wastes, longer-term measures may be necessary to effectively mitigate any long-term adverse impacts. The long-term measures should be considered after the initial/emergency actions are completed.

B. Remedial investigations can include the following detailed investigations:

1. Surface soil samples near the site.
2. Core soil samples of the top 10 feet of soil around the site.
3. Groundwater monitoring, which may include the necessity of constructing wells into the soil/subsoil, the Grainy Sandstone, the Madison Shale and even the Fairview Sandstone.
4. Plume identification. If groundwater contamination is found in areas in addition to the existing 10-foot well, additional wells will need to be installed to determine how far any plume of contamination has migrated.
5. Metal detection might be necessary to determine whether any barrels are buried in the area.

C. Feasibility study. Based upon the information developed during the remedial investigation, remedial alternatives should be considered to correct any problems and eventually allow unrestricted use of the property. Alternatives considered during a feasibility study could include the following:

1. Additional excavation and removal.
2. Treatment of contaminated groundwater.
3. Installation of clay or cement containment walls between the site and Flower Hill Lake to protect the lake from contamination.
4. Other treatment technologies.

D. Cleaning up pollution can be very expensive. Individuals working at the site may have to be trained to deal with hazardous substances and may have to wear protective gear. Funding for these measures may be available from the U.S. EPA's Superfund Program, from the Illinois Superfund program administered by the IEPA, or by any company that could be held responsible for generation or illegal disposal of the hazardous wastes.

Quiz

HAZARDOUS WASTE INTELLIGENCE QUOTIENT QUIZ

INSTRUCTIONS: Circle the correct answer.

1. What percentage of all hazardous waste is generated by the chemical industry? a) 30 percent b) 60 percent c) 90 percent

2. The total number of businesses that produce hazardous waste in the United States is about: a) 700,000 b) 50,000 c) 250,000.

3. Hazardous wastes which eat away materials and living tissue are known as: a) ignitable b) corrosive c) toxic

4. A person or business which produces hazardous waste is known as the: a) disposer b) percolator c) generator

5. The first location to receive national attention for hazardous waste was: a) St. Louis, Missouri b) Los Angeles, California c) Love Canal, New York.

6. The state which generates the highest amount of hazardous waste is: a) Illinois b) New Jersey c) Missouri

7. Which of the following is not considered a hazardous waste? a) benzene b) mercury c) paper

8. Liquid formed when water seeps through the waste in a landfill is known as: a) percolate b) leachate c) sludge

9. A solid or semi-solid waste material left after sewage treatment that can be hazardous or non-hazardous depending on the composition is: a) run-off b) sludge c) reactive.

10. Hazardous wastes: a) can be handled without protective gear b) pose a threat to human health c) are not found in Illinois.

SCORE

8-10 correct — hazardous waste superstar
5-8 correct — average
Below 5 correct — need help

Quiz-Teacher's Key

NOTE: This is a fun quiz to be used as a teaching tool to introduce information on hazardous waste.

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Below 5 correct — need help

Experiment

MICRO-PONDS

PURPOSE: To trace how hazardous materials affect the environment by establishing a series of micro-ponds.

MATERIALS: Aquarium, plants or algae, and a common household product.

PROCEDURE:

1. Set up an aquarium which contains algae or other plants.

2. Carefully study each aquarium, listing type of plant and population.

3. Select a commonly used product such as detergent, auto polish, soap, paint, fertilizer, insect poison, hair spray, toothpaste, etc.

4. Introduce the substance into the micro-pond. Compare population densities. The amount of substance should be carefully controlled to allow a meaningful investigation.

5. Students can design their own experiment. They should outline the steps and form a hypothesis.

MODULE 5: Recycling

Student Resources	*Give Your Trash A Second Chance (Text)* *Do Other Countries Recycle? (Handout)* *How Long Does it Take Our Garbage to Decompose and Turn to Dust? (Handout)* *Recycling is as Easy as Taking Out the Garbage (Two handouts)* *Composting: An Alternative to Burning (Handout)*
Activities	*Readin', Rottin' and 'Rithemetic: Classroom Composting (Experiment)* *Composting: A Great, Rotten Idea (Discussion)* *Reducing Class Trash (Activity)* *Trash or Treasure? (Activity/worksheet)* *Make Your Own Paper (Project)* *Throwaway Three (Skit)*

5

GIVE YOUR TRASH A SECOND CHANCE

How many throw-away conveniences have you come to enjoy - even take for granted - in your home, on the job, or when you're out having fun? So many that experts have called the U.S. a "disposable society". Yet those disposable products and other trash have also helped us to set a world record for the mountain of garbage that we produce each year.

For most people, it doesn't seem right to throw something away that can be salvaged and reused. That's the idea behind recycling. Before valuable materials reach the landfill, we can intercept them and manufacture new, useful products. Today, about 10 percent of our total waste stream - 15 million tons per year - is recovered and returned to commerce. Here are some examples:

- *Aluminum cans* are widely recycled because it is much cheaper to reclaim them than to make new aluminum from bauxite ore. Already, more than half of these cans are reused; by the 1990s, container manufacturers expect to collect 75 percent of the 50 billion beverage cans that are thrown away every year.
- *Paper* is our most plentiful discard. Nearly 30 percent of all paper is now reused to make insulation, building materials or other paper products. In all, about 13 million tons are recovered each year - including 4 million tons that are exported to foreign markets.
- *Glass bottles and jars* are also in high demand. About 5 billion of these are collected and remelted each year to produce new containers. By using "cullet" (crushed glass) instead of virgin raw materials, manufacturers also reduce the air and water emissions that often occur when new glass is made.
- *Plastic containers* are increasingly finding a second life as fiberfill stuffing for pillows, ski jackets, sleeping bags and automobile seats. As new markets are developed, the recycling rate for plastic soft drink bottles is expected to rise far above today's 20 percent.

- *Rubber tires* can be reprocessed or burned as fuel to produce energy.

Of course, not everything can be recycled. Soiled or coated paper, disposable diapers, certain plastics, empty paint cans - none of these is likely to find an eager buyer. Like other trash, they must be sent to a combustion facility or landfill. And eventually, even recycled materials wear out or deteriorate. Still, well-run recycling programs can play a major role in reducing our overall disposal needs: up to 20 or 25 percent of the country's waste stream can be recovered and reused.

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Handout

DO OTHER COUNTRIES RECYCLE? YES!!!

FRANCE collects plastic bottles from homes every day and recycles them.

CHINA collects old shoes, grinds them up and makes paper out of them.

JAPAN has organized a door-to-door collection of all kinds of waste paper in exchange for toilet paper and tissues. The Japanese recycle about 50 percent of all the paper they use.

In the PHILLIPINES, garbage is the only source for worms on large scale worm farms. The worms are used to keep the soil aerated and as soil fertilizer.

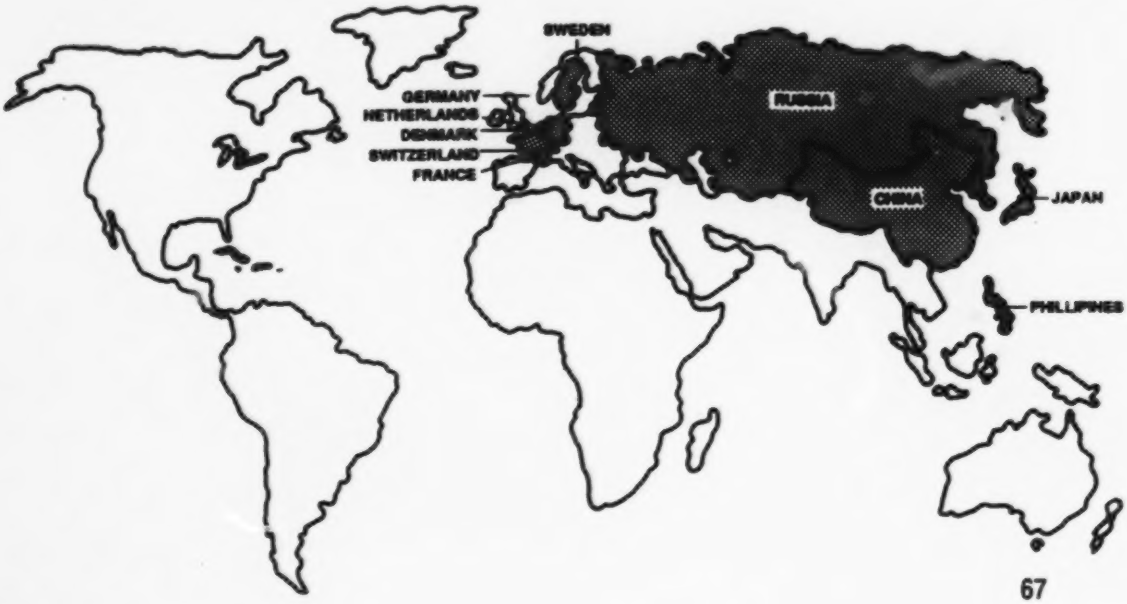
FRANCE and GERMANY burn garbage as fuel in waste treatment facilities. The steam from the burning is sold to factories to drive generators.

The separation of waste paper from all other garbage in homes, shops and offices is required by law in most of SWEDEN.

More than half of all the people in SWITZERLAND recycle the glass they use at home.

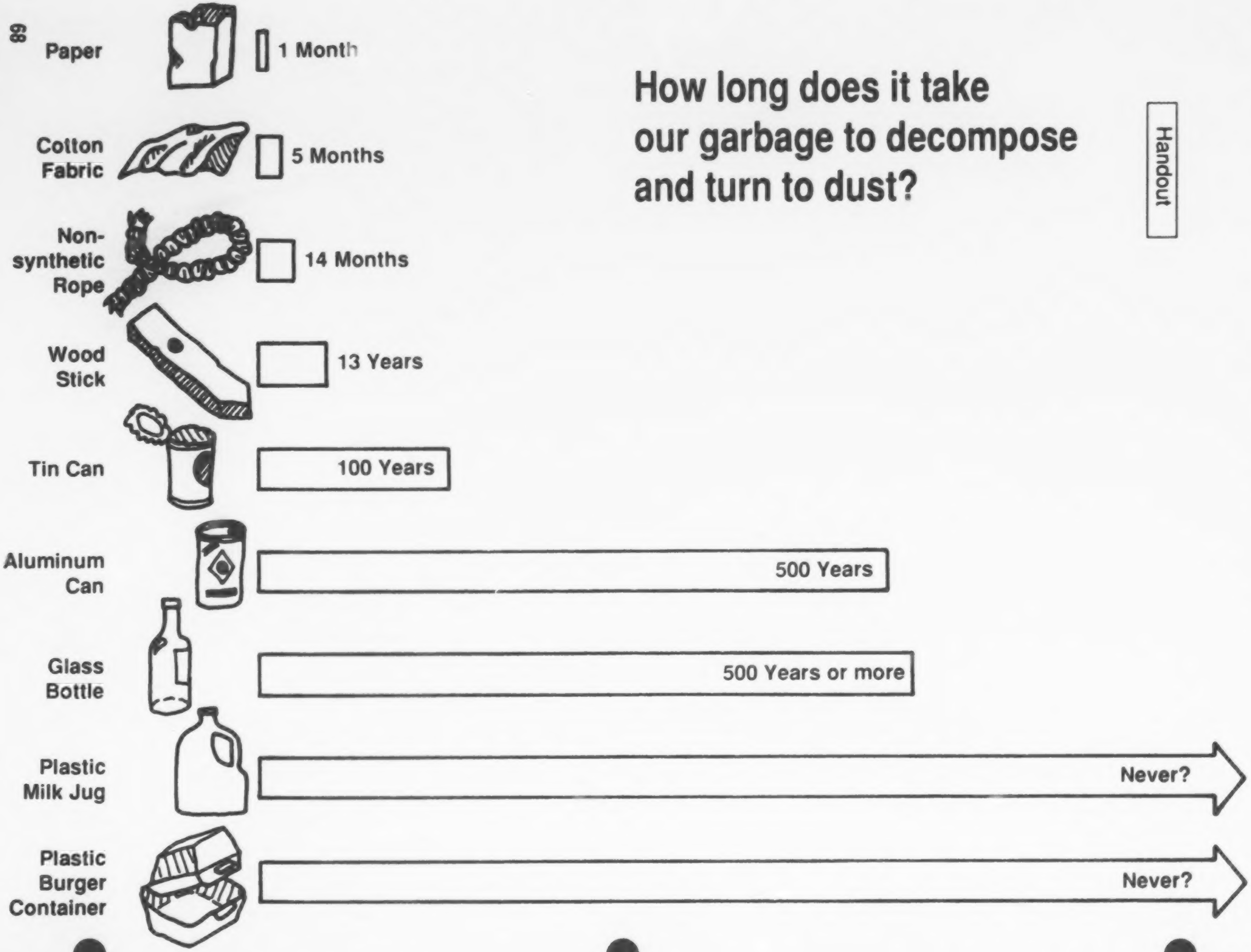
The governments of GERMANY, DENMARK and the NETHERLANDS require the use of recycled paper in municipal offices.

RUSSIA recycles almost all the paper it produces, and because of a high deposit fee, the people return or recycle most glass bottles.



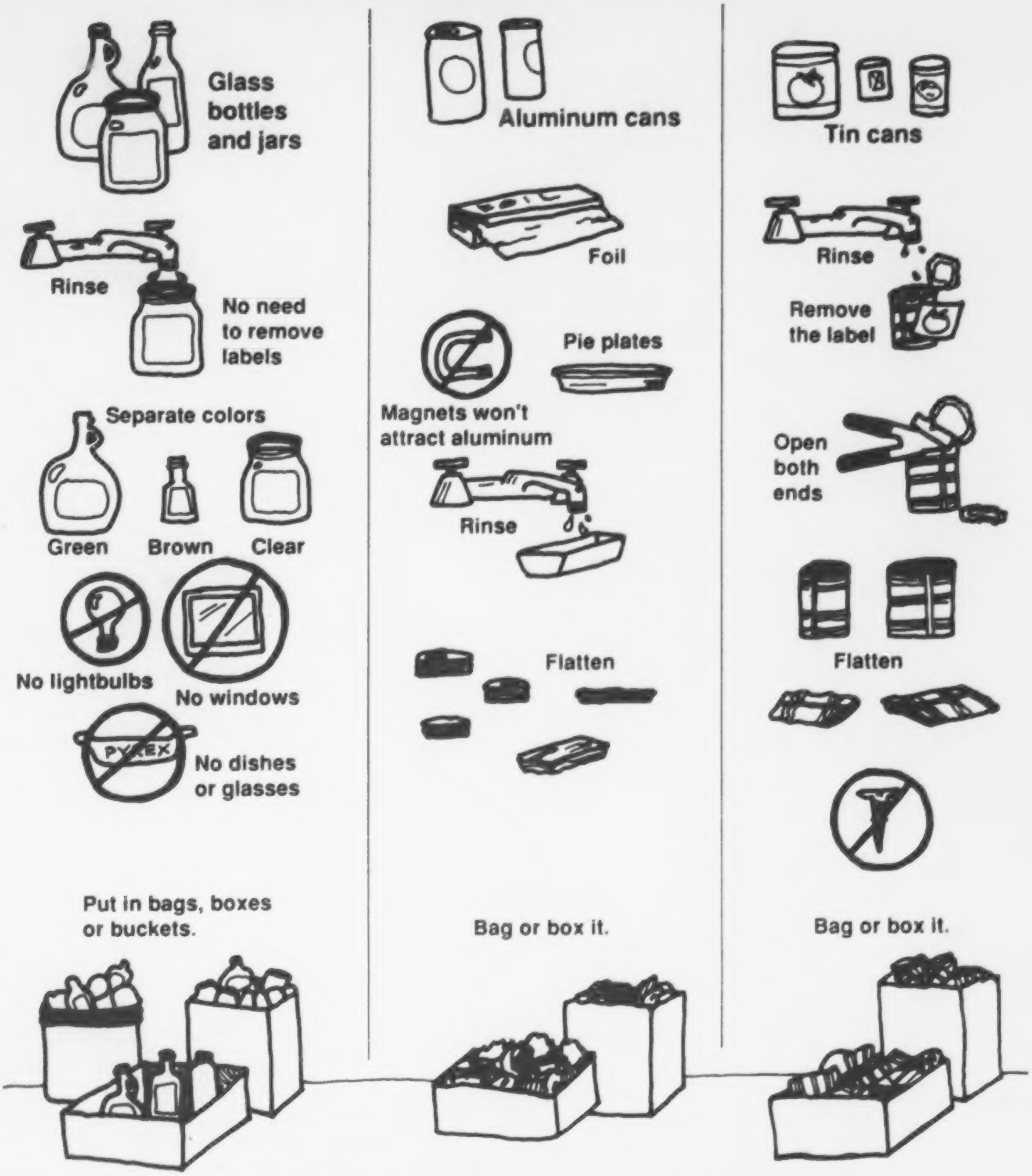
How long does it take our garbage to decompose and turn to dust?

Handout



Handout

RECYCLING is as EASY

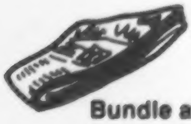

Glass bottles and jars
Rinse
No need to remove labels
Separate colors
Green
Brown
Clear
No lightbulbs
No windows
PYREX
No dishes or glasses
Put in bags, boxes or buckets.
Aluminum cans
Foil
Pie plates
Magnets won't attract aluminum
Rinse
Flatten
Bag or box it.
Tin cans
Rinse
Remove the label
Open both ends
Flatten
Bag or box it.

as Taking Out the Garbage

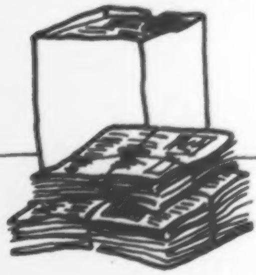
Handout

RECYCLING is as EASY

Newspaper

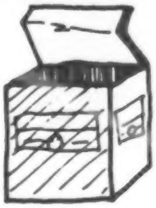


Bundle and tie
or put in large
grocery bags.

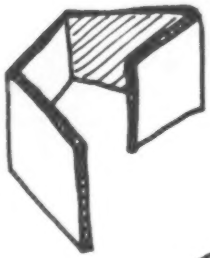


Kraft paper
and corrugated cardboard

Grocery bags

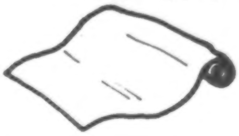


Boxes

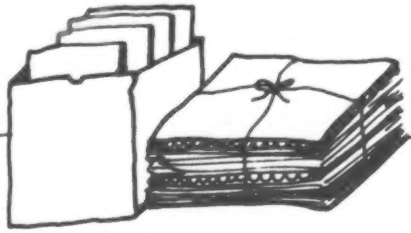


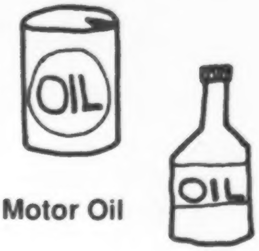
Look for the
ribbed, wavy layer.
Flatten the
cardboard

Brown
wrapping paper

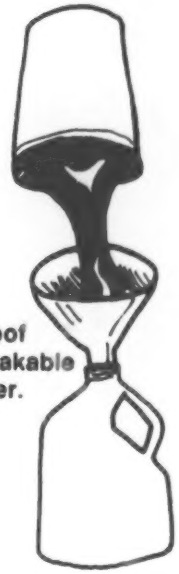


Bundle, bag or box it.
(Include the kraft paper)



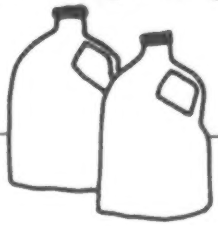


Motor Oil



Pour
motor
oil
into
clean
leak-proof
non-breakable
container.

Put on the tight-fitting lid.



as Taking Out the Garbage

Handout

COMPOSTING: AN ALTERNATIVE TO BURNING

What to do with leaves is a question that poses a problem for many every fall.

An IEPA suggestion that will help keep the air clean, eliminate the expense of bagging leaves and provide you with a valuable garden additive next spring is composting.

Building a compost heap is a great way to turn your leaves and grass clippings into rich humus which can be added to soil and improve soil quality. Adding compost to clay soil helps loosen the soil to allow easier growth of plants.

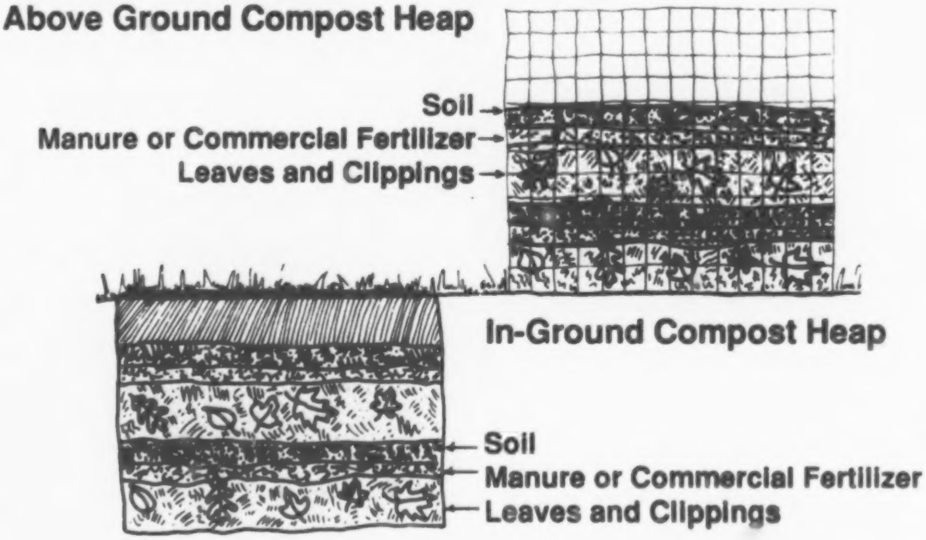
Beginning a compost is easy. You can dig a hole about 3 feet deep and 3 feet square which will be large enough to hold a season's worth of clippings and leaves. If you don't want to dig a hole you can use a 12 foot piece of fence. Secure the fence on three sides and allow the fourth to be used as an entrance.

Add leaves, grass clippings and any available hay, straw, sawdust, ashes and weeds.

When the pile reaches 8 inches thick, add a 2-inch layer of manure and a 2-inch layer of soil. These components are needed in the decomposition process.

As you add the layer of leaves, soil and manure, keep the pile moist. Turn the pile occasionally so that the entire pile decomposes quickly and completely.

Next year, when you and your family are ready to plant a garden or a flower bed, the compost pile will add a rich supply of humus to help make the plants and flowers grow.


Above Ground Compost Heap
Soil
Manure or Commercial Fertilizer
Leaves and Clippings
In-Ground Compost Heap
Soil
Manure or Commercial Fertilizer
Leaves and Clippings

Experiment

READIN', ROTTIN' AND 'RITHMETIC: CLASSROOM COMPOSTING

GOAL: To have students learn about recycling in nature and actually recycle organic matter by composting.

MATERIALS: Fish aquarium; organic waste materials (be sure to add a variety of materials, such as, sawdust, hair, wood ash, leaves and food scraps *except* meat scraps, fats and oils, which inhibit decomposition and in an outdoor compost pile can attract dogs, rats, raccoons and other animals); lawn fertilizer (that contains nitrogen but *not* herbicides or insecticides), manure and/or green grass clippings which also contain large amounts of nitrogen (a ratio of 25-30 parts carbon to 1 part nitrogen is ideal); soil; one to two dozen red earthworms (obtain from yard, garden, school grounds or local bait shop); thermometer; and a trowel or large kitchen spoon.

NOTE: *Air circulation is important to decomposition, thus the best compost bin is one with wire or screen sides. Mass also is important, since approximately one cubic yard of compost is needed to generate good decomposition temperatures (104-107 F). Thus, an aquarium, with its small size and glass sides, isn't the best compost container. Consider constructing an outdoor compost pile with wire sides on the school grounds. (See* "Composting: An Alternative to Burning" *handout for instructions).*

PROCEDURE:

1) What "ingredients" do you think are needed to construct a compost pile? Why? List ingredients. For example:

- SOIL: Contains micro-organisms that help decomposition.
- ORGANIC WASTES (Such as leaves, food scraps and grass clippings). Wastes should be varied, including materials with both carbon and nitrogen. By alternating layers of high-carbon and high-nitrogen materials, you can create good environmental conditions for decomposition to occur.
- NITROGEN: Many of the organisms responsible for decomposition need nitrogen, thus nitrogen is necessary for rapid and thorough decomposition. Nitrogen is found naturally in many organic wastes, and in many commercial fertilizers.
- WORMS: They eat the waste, helping to break it down; make droppings, which enrich the soil; tunnel through and aerate the waste, facilitating decomposition; and eventually die and become part of the compost.

- **WATER:** Necessary for normal functioning of life. Too much water in a compost pile may make it soggy and slow decomposition by reducing needed oxygen.
- **AIR:** The biological activity of fungi, bacteria, small insects and other organisms results in decomposition. Most biological processes require adequate amounts of oxygen.
- **TIME:** Decomposition takes time. To speed up decomposition, aerate your pile every few days; otherwise, just leave it and wait.
- **HEAT:** Heat is produced by chemical reactions resulting from increased biological activity that occurs during decomposition. Heat helps sanitize compost by killing certain organisms (i.e., weed seeds, pathogens, harmful insect larvae.)
- **MASS:** In order to generate enough heat for optimal decomposition, the pile must contain at least one cubic meter of organic material. Thus, the temperatures generated in an aquarium compost pile may be different from those generated in one that is larger.

2) Design a place for making a mini-compost pile in the classroom. Decide which ingredients students will provide and which will be supplied by the teacher. Set a date for constructing your pile.

3) Suggestions for creating a mini-compost pile:
   a) Chop the organic wastes into small pieces. You can leave some large pieces of the same materials to compare rates of decomposition between large and small items. Why might there be a difference?
   b) Alternate layers of the materials as follows (amounts are approximate): inch of soil, two inches of organic waste, sprinkle of fertilizer, sprinkle of water, repeat.
   c) Cover with an inch of soil. Water the pile enough to make it moist but not soggy. It should feel like a damp sponge (it feels moist, but you can't squeeze water out of it.)
   d) Add the earthworms and observe their behavior.
   e) Place your compost pile where it will be at room temperature (not in direct sun).

4) Place the thermometer in the middle of the pile. Wait an hour or so, then record the temperature.

5) Record the temperature from the same location and depth, and at the same time each day. Why is it a good idea to be consistent with location,

depth and time of recording? Does the temperature change? Why or why not? Make a graph to show your temperature results.

6) Gently mix the compost once a week to aerate it. A good time to turn the compost is after the temperature peaks and begins to drop. Why? Be sure to record the temperature before you turn the compost that day.

7) Be patient. Occasionally check the moisture and add water if needed.

8) Make a chart to help you keep a daily record of temperature and other observations during the next month or two. Observe:
- Which materials break down the fastest? Slowest? Why?
- Are there any odors? Why do you think decomposition has an odor?
- Does the texture of the compost change? In what ways?

9) Once the materials in your compost pile have decomposed into humus, conduct the same feel and smell tests.

10) Now decide what your class should do with this rich soil. When you clean out the aquarium, should you: dump the humus in the trash: take it outside and dig it into the soil; use it for growing plants in the classroom?

11) Discuss:
- How does composting reduce the amount of waste you would have thrown out?
- Is the landfill a gigantic natural compost pile, or are there problems with placing large amounts of organic materials in landfills?

12) Now that you have constructed and maintained a mini-compost pile in the classroom, how would you go about constructing and maintaining one at home?

PRE- AND POST-INSTRUCTION QUESTIONS:
- *What is composting?*
- *What are the necessary "ingredients" for a good compost pile?*
- *How is composting related to the concept of recycling?*
- *How can composting reduce waste?*

Discussion

COMPOSTING: A GREAT, ROTTEN IDEA

BACKGROUND: When we mention "recycling", we often think of recycling glass bottles, aluminum cans and newspapers. But another 30 percent of the household garbage we throw out also can be recycled. These recyclables are food scraps, leaves, grass clippings and other biodegradable organic wastes. Organic wastes can by recycled by composting. Simply stated, composting creates optimal conditions for decomposition to occur. Decomposition is the biochemical process by which bacteria, fungi and other microscopic organisms break organic "wastes" into nutrients that can be used by plants and animals. Decomposition occurs in nature whenever a leaf falls to the ground or an animal dies. It is essential for the continuation of life on earth. The result of decomposition in a compost pile is a nutrient-rich humus that is excellent for improving soil quality and plant growth.

GOAL: To have students investigate the pros and cons of composting.

PROCEDURE:

1) Define: recyclable, biodegradable. List items that are recyclable and/or biodegradable.

Discuss:

- Are there recyclable materials that aren't biodegradable? Are there biodegradable materials that aren't recyclable?

2) Feel, smell and look at the rotting log, grass clippings, leaves or food scraps. What words would you use to describe these materials? List these words. Do the words have positive and/or negative connotations? Why?

3) Explain what is happening to the rotting material.

Discuss:

- What is the natural process that breaks biodegradable material into particles that can be used again by plants and animals? (decomposition)
- What will your rotting material finally become? (humus)

4) Imagine a world where decomposition doesn't take place.

Discuss:

- What would happen to organic materials like dead animals, leaves or sewage?
- Could plants and animals survive if decomposition doesn't occur? Why or why not?

- Is decomposition important? Why?

5) Now think of words to describe rot or decomposition. List them. Do the words have positive and/or negative connotations? Why?

6) List items you throw away that are biodegradable.
Discuss:
- How might you and your family recycle these materials?
- What is composting?
- Why do you think people compost household organic wastes?

7) What are some benefits of composting household food and yard wastes?
For example:
- Composting reduces the need for purchasing and using expensive plastic garbage bags.
- Composting saves the cost of transporting wastes to a landfill. How much money do Illinois citizens spend each year disposing of their compostable wastes?
- Composting saves space in the landfill. Illinois' sanitary landfills are filling up fast. Within 10 years, most existing landfills will be filled to capacity.
- Composting reduces pollution from landfills.
- Composting creates nutrient-rich humus you can use to fertilize and improve the texture of your yard and garden soil, saving money you might spend on mulch or fertilizer.

8) What are some possible problems with composting? What suggestions do you have for solving the problems?
For example:
- *Composting is too much work.* Mowing the lawn and washing the car are work, too, but we choose to do these activities because they're satisfying -- so is composting! And composting has a positive impact on the environment, which can make us feel good.
- *You'd have to run outside every time you eat an apple or peel a potato.* Just place food scraps into a plastic container with a lid. Keep the container in or under the kitchen sink, then take the waste to the compost pile whenever the container is full.
- *It's easier to use the trashbag or garbage disposal.* Once you make it into a routine, composting is easy, too. It can make you feel good about doing something positive for the environment by using instead of wasting

the fertilizing potential of your garbage. Also, landfilled yard wastes and food scraps take up valuable landfill space and may release harmful methane gas. Food waste put down the garbage disposal ends up in the sewage system, where treating it can tax the system and costs money. If you can afford a garbage disposal, perhaps you can afford a "no work" composter. Easy to use, compact and attractive composting bins are available commercially.

■ *Compost piles smell and attract insects.* If you maintain your compost pile according to basic guidelines in the handout, "Composting: An Alternative to Burning," your pile shouldn't smell or attract insects.

9) How would/do you compost your household wastes? Where can you find information to help you? Write or call the Illinois Environmental Protection Agency.

NOTE: *Some communities may have regulations about yard composting. Before conducting any school composting experiment, check with the local officials (alderman, commissioner or public works director) about possible local rules.*

Activity

REDUCING CLASS TRASH

GOAL: To have students realize that reuse and recycling of materials aren't the only or main solutions to the solid waste problem. A key step is to cut down on the use of materials that become solid waste.

PROCEDURE:
1) In what ways can you reduce the amount of trash you throw out at school? Don't forget to consider waste from the art room, shop, lunch room, etc. Write your ideas on the blackboard and request that it not be erased for one week.

2) For one week, cut down on your use of paper, food packaging and other materials. Refer to the suggestions on the blackboard. Note: It isn't fair to "cut down" by throwing things out in other trash cans in the school.

3) At the end of each day, calculate the amount of trash and list what individual items make up most of the trash. Calculate the volume of trash in each bag by measuring the width, length and depth of items in it.

4) Compare your findings with the amounts calculated in the "Class Trash" activity. (See Module II.)

Calculate:
- Did you throw out less trash when you tried to cut down? How much less?
- If your class cut down on use of materials for the school year, how much less trash (in pounds) would you send to the landfill?

Discuss:
- How easy is it to cut down on how much you use?
- Do you feel that it is worth doing? Why?
- Will you continue to cut down on your use of materials, or is this class activity a one-shot deal?

Pre- and Post-Activity Questions:
- *How can you reduce the amount of trash you generate in your class/school each day?*

GOING BEYOND:

- Take home a copy of the checklist and questions and fill it out. Note to teacher: *Include a cover letter to parents explaining that the class is studying solid waste and recycling, and that you would like them to help their children see what kind of solid waste is generated at home.*

Discuss:

- What did you find out about what your family throws away?
- How do you feel about your findings?
- What ideas do you have for what you could do with the trash generated at home?
- Trace the "afterlife" of one of the items on the checklist. For example, what happens to the plastic bag or paper milk carton after it's taken to the landfill? Does it decompose? Does its decomposition create harmful byproducts? What impacts might its decomposition have on air, soil, water and health?
- Create a reusable item from something you're going to throw away.
- Investigate what used materials organizations like the Salvation Army and Goodwill Industries need and what they do with the materials they receive.
- Discuss the role of yard sales, garage sales or tag sales in recycling and reusing materials.
- Investigate how the amounts and types of wastes generated by a bank, grocery store, clothing store and hospital differ. How does each business dispose of its waste? Do any recycle materials?
- Americans generate more trash per person than the people of any other country in the world. How do you feel about this?
- Research and report on waste disposal habits of other countries. How do they deal with solid waste? Why don't they make as much trash as Americans?

Activity

TRASH OR TREASURE?

GOAL: To have students find out why, how and where they should recycle or reuse what they typically throw away.

PROCEDURE:
1) Is there anything else you can do with what you throw away? List your ideas. Most of them will fit into one of the following four categories: reuse, recycle, recover energy, landfill. Write these four categories on the board. What trash items might fit best into each category? List them under the proper category heading.

2) Do a) and/or b), then answer the discussion questions:

a) To the teacher: *Give each student a copy of the following checklist to fill out, or put the list on the board and work through it as a group. (A copy of the checklist is available in the educational packet).*

Directions: Put an X next to the items you threw in the wastebasket this week.

______Paper bag
______Newspaper
______Book
______Magazine
______Paper milk carton
______Other paper
______Napkin
______Aluminum can
______Apple core
______Old clothes
______Plastic milk carton
______Tin can
______Glass jar
______Gum wrapper
______Orange peel
______Plastic bag
______Broken toy
______Grass clippings
______Other

Now circle all the items you think could have been reused or recycled.

Discuss:

- What items did you circle?
- How could you have reused items?
- Did you wonder whether the napkin was paper or cloth? What difference might this make?
- What could you have done with the recyclable items?
- What could you have done with apple cores and orange peels?
- Which items are difficult to reuse or recycle? Why?
- Should we as a society be making products that aren't reusable or recyclable?
- Should items that are wrapped in difficult-to-dispose of packaging cost more?
- Did any of your classmates reuse or recycle any items you circled?
- How did they reuse or recycle the items?
- Was reusing or recycling them easy to do? Why or why not?
- What do you think happens to the items you didn't circle?

b) Sort the items that your class threw out in one day into the following categories: reusable, recyclable, other. Discuss:

- Why did you place each item in the category you chose? Does your class recycle any of the items?
- Should your class recycle them? Why?
- Are there some items your class could recycle but doesn't? Why doesn't your class recycle them?
- Are there places in school aside from the classroom where you discard trash during the day? Think about how much food and how many food wrappers, cans and bottles you discard at lunch, how many paper towels you use to dry your hands, etc.
- What happens to the items that aren't reusable or recyclable?

3. Investigate where in your community you can take items to be reused or recycled.

- How can you find out about local recylcing programs? (Contact: Illinois Environmental Protection Agency, Illinois Department of Energy and Natural Resources, local natural resources and environmental groups, glass manufacturers, recycling businesses and municipal public works departments)

- Make a list with the following information about the businesses or organizations that recycle: name, address, telephone number, materials recycled, hours of operation, whether the organization will pay you for materials, any other useful information.

4. Investigate and discuss:

- What are some advantages of recycling? (Conserves natural resources, saves energy, protects the environment, can make money, creates jobs for people involved in recycling and reduces our dependence on imported materials.)
- What are some disadvantages of recycling?
- What are the pros and cons of energy recovery and landfilling?

5. Brainstorm the steps your class might take to design and implement a recycling project for your classroom or school. Select a project that is feasible. For example, collect and recycle paper from the school's copy machine and classrooms. Who can you contact to help you with your project?

6. Consider doing your project!

Pre- and Post-Activity Questions:

- *What is recycling? What are reuse, energy recovery and landfilling?*
- *What types of solid waste can be recycled, reused, recovered or landfilled?*
- *What can you do in your school to recycle solid waste?*

Worksheet

TRASH OR TREASURE?

Directions: Put an X next to items you threw in the wastebasket this week.

_____ Paper bag

_____ Newspaper

_____ Book

_____ Magazine

_____ Paper milk carton

_____ Other paper

_____ Napkin

_____ Aluminum can

_____ Apple core

_____ Old clothes

_____ Plastic milk carton

_____ Tin can

_____ Glass jar

_____ Gum wrapper

_____ Orange peel

_____ Plastic bag

_____ Broken toy

_____ Grass clippings

_____ Other

Now circle all the items you think could have been reused or recycled.

Project

MAKE YOUR OWN PAPER

MATERIALS: Ten pieces of tissue or newsprint, a piece of screen, a flat dish (a little larger than the screen), four pieces of blotting paper the size of the screen, a bowl, an egg beater (it works better with a blender), a round jar or rolling pin, newspaper and blotter paper, two cups of hot water, two teaspoons of instant starch.

PROCEDURE:
1) Tear the paper into very small bits into the bowl. Pour in the hot water.
2) Beat the tissue and water to make pulp.
3) Mix in the starch.
4) Pour the mixture into the flat dish.
5) Slide the screen into the bottom of the dish and move it around until it is evenly covered with pulp.
6) Lift the screen out carefully. Hold it level and let it drain for a minute.
7) Put the screen, pulp side up, on a blotter on some newspaper. Put another blotter over the pulp, more newspaper over that.
8) Roll the jar over the sandwich to squeeze out the rest of the water.
9) Take off the top newspaper. Turn the blotter sandwich over so that the screen is on the top. Then take off the blotter and the screen very carefully. Don't move the pulp. There is your paper.
10) Put a dry blotter on the pulp and let it dry.

Skit

THROWAWAY THREE

"Throwaway Three" is a skit in rhyme written for three actors, but a different person may be used for each of the 10 roles, thus involving a larger number of students.

Each part has three notations beside it. The first is the character (Monkey, Cave dweller, etc.). The second is that character's date in history. Make signs for each of these dates and have one person hold up the appropriate date sign at the appropriate time in the skit. The third notation describes the props. This includes both the costume for the person in history and the articles thrown away.

The central idea is that as the skit progresses, each person throws more trash on the pile in the middle of the room so that a high stack is created. The skit suggests that one way to solve the problem is to recycle. A discussion of ways to solve the problem of too much garbage and trash might follow the performance.

THE THROWAWAY THREE

Person 1
This is the tale of the Throwaway Three
Of Man and his Garbage throughout his-to-ry:
Now they're very nice people, just like you and me,
Who all have a problem, as you will soon see —
What shall they do with their garbage and trash.

PROPS

All
Why, throw it! Or bury it! Or burn it to ash!

Person 2
90,000 BC
(Monkey)
I represent people when we lived in a tree.
I get rid of my garbage so easily!
It's a snap! It's no problem - to me, or to him.
We just let go, plop! Down through the limbs!

Monkey Masks
Banana Peel
Orange Peel

Person 3
50,000 BC
(Cave dweller)
I am a cave dweller who lives on the ground.
What do I do with old stuff all around?
Why, burn it, like meat; burn it up in the fire;
Or bury it like bones, in the muck and the mire.

Skins

All
Yes, throw it, or bury it, or burn it to ash!
That's how we always get rid of our trash!

Person 1
200 BC
(Roman)
I am a Roman who lives in the town.
Our laws won't allow me to just throw it down.
I have to drag it away for a mile
And then I can dump it, forget it and smile!

Roman Helmet
Bag of Trash

Person 2
1200 AD
(Briton)
I am a Briton, wary and quick;
Down on our street it can get pretty thick.
When housewives up there want to pitch out their goo,
They just heave it out there and yell: "Gardy-loo!"
(Person 1 stands on chair and yells "Gardy-Loo!")
It will stay there and stay there until the next rain,
Or until our fair London should burn down again.

Sack of trash

All
Oh, what do we do with our garbage and trash:
We throw it, or bury it, or burn it to ash!

Person 3
1630
(Settler)
I am settler. I came without much,
Oh, a rifle, an axe, some few tools and such.
But everything else I must make with my hands.
So I don't throw out much - I use all I can.
Cloth scraps become quilts; I reuse my bent nails.
It will be a long time 'fore the next trade ship sails.

Pilgrim Hat
Quilt

Person 1
1700
(Colonist)
I am a colonist; now life's not so tough.
We have trade between cities that brings lots of stuff
And some things are made by our townfolk today,
I could buy a new harness, throw this old one away.
We have pigs and hogs running loose in our street,
If I toss it out there, they'll eat it up neat!
Or I might bury it right over there.
Or I might burn it; nobody would care.

You see; the New World is the same as the Old!
We trashmakers come from a time-honored mold.

Coonskin Hat
Leather Harness or Belts

All
What are we still doing with garbage and trash?
You guessed it! Throw it or bury it or burn it to ash!

Person 2
1890
(Industrialist)
I'm the industrial person and new on the scene,
I mass-produce goods with my trusty machine.
This sweater, handmade, took a week in days of yore,
But now in one hour, I can make fourty-four.
I make things so cheaply, you can now afford two,
And throw out twice as much trash as you need to do.

Engineer's Cap
3 sweaters
(One handmade; two machine-made)

Person 3
1950
(Scientist)
I am the scientific person in the new post-war age.
We've learned a few tricks while the war shortage raged.
When we couldn't get natural stuff to process
We invented synthetics to replace the rest.

Lab coat

Person 2
(Industrialist)
Rayons and nylons, acrylics and plastics
For furniture and clothing and even elastics;
Forget your old woolens and silks and your cotton;
Real wooden toys and washboards are forgotten.

Nylon stockings
Plastic Bags & Containers

Person 3
(Scientist)
Our new stuff will last till forever, you see
Even when it's worn out to you and to me.
Permanent pressed, pre-sized and pre-shrunk
When dingy and old, it's still permanent "junk"
(Person 1 yells, "Junk".)

Perma-Pressed Shirt

Person 2
(Industrialist)
We make instant menus that come in a pack.
You just boil the food in its own plastic sack.
Or our TV dinner in its tinfoil tray
It's quick; you don't wash it; just throw it away!

Plastic Bag
TV dinner

Person 3
(Scientist)
We make lots of TVs and clothes dryers, too.
Don't ask for a trade-in; you're kidding, aren't you?

Broken Small Appliance

Person 2
(Industrialist)
Our new cars all change with each model year
Don't try to repair them, the cost's much too dear.
Besides, we don't bother to make last year's parts
For Skylarks or Novas or Cougars or Darts.

Toy car

Person 3
(Scientist)
It's the New Thing, the NEW that America craves.
So out, out with the old stuff, away to its graves.

Person 2
(Industrialist)
So what if there're more of us buying more goods?
So what if they won't rot away as they should?

Person 1
(Indian)
Now wait just a minute! You can not fail
To include me in your historic trash tale.
We Indians lived simply, on prairies, in woods,
We made no high trash piles, nor mass-produced goods.
Let me be your critic, show you where you stand;
And tell you just how you're defiling our land.
Your new-fangled goods will not rot away.
When you throw them all down they remain where they lay
Then you say you will bury them deep in the ground:
All your urban trash will make quite a mound!
So then you would burn it, in smoldering masses
And fill up our air with smoke, deadly gases!
Oh, all of your answers have faults everywhere:
You'll either ruin the water, the land or the air.
What's more your resources - your lumber, your ore -
Get smaller each year than the year just before.
And what's more - this old earth's not making any more.

Indian Headband

Person 2
(Industrialist)
You're right. Our resources are shrinking away
While our garbage problem grows bigger each day.
We're always converting resources to refuse
Instead of recycling them for reuse!

Throw out old blanket and cola bottle

Person 3
(Scientist)
Oh stop it! Don't drop it! We'll think of a way
To make food for cows that's much better than hay.
Don't burn it, return it - we'll make something new,
A vase for your mother, a spyglass for you.
(Flower in bottle for vase, flower out, bottle held up to eye for spyglass.)
Don't bury it, carry it - back to the mill.
We'll make a new blanket to ward off the chill.

Pick Up Old Blanket and Wrap Around Shoulders

Person 2
(Industrialist)
It's time we progress past the Disposal Age
And make recycling the popular rage!
We'll have to give up old solutions for trash
And all realize that its pure balderdash - to just

All
Throw it, or bury it, or burn it to ash!

DISCUSSION

The skit shows the children that people have historically gotten rid of solid waste successfully by throwing it out, burying it, or burning it. But none of these methods solves modern urban garbage problems. The discussion should attempt to reinforce this concept. One way this can be done is to discuss the characters in the skit: how they disposed of their garbage or trash and why their method of doing so was either satisfactory or not satisfactory.

Monkey: Threw it down.

No problem developed because no large concentration of monkeys existed. The garbage disintegrated.

Cave dweller: Threw it, burned it, buried it.

These acts still did not cause a problem for the same reasons.

Roman: Threw it.

Tossing out garbage began to be a problem because of the many people who lived in cities, but it was easily solved by taking the garbage out of the city.

Briton: Threw it.

A problem grew because more and more people moved to the cities, thus producing more trash than they could get rid of in the city.

Settler: Had virtually no garbage.

Colonist: Threw it, burned it, buried it.

Greater trade resulted when people did not use goods until they wore them out, but then more things to be discarded began to accumulate.

Industrialist:

With a greater concentration of people in cities than ever before and more buying because machine-made goods were cheaper, much more was thrown out.

Scientist:

The big change to synthetics plus the use of enormous amounts of natural resources are causing tremendous problems.

We can't throw away our trash. There simply is no such place anymore. Care is always required to prevent our trash from having bad effects on our lives.

We can't bury it all. Not enough places are available. Besides, the modern synthetics do not decompose when buried.

We can't burn it all. Some of the synthetic goods simply won't burn. Most of the burning requires expensive and often elaborate controls to prevent air pollution. And there is always ash or something left over which must be buried.

We are literally running out of some natural resources so that any form of disposal of certain goods is self-defeating.

APPENDIX

Guidelines for Recycling Wastes in School

IEPA and Environmental Laws

Jeopardy

Wheel of Fortune

Dictionary of Environmental Terms

Additional Classroom and Outside Activities

Crossword Puzzle Fun

GUIDELINES FOR RECYCLING WASTES IN SCHOOLS

There are a lot of good reasons to recycle! Recycling saves energy and resources, saves room in our landfills, reduces pollution, keeps down disposal rates and provides materials for new products. A school recycling program can accomplish some additional objectives:

1) It is an effective hands-on approach to environmental education and helps students develop environmental competencies.

2) A school can save money by reducing the amount of garbage that needs to be collected for disposal.

3) A school might make money from the sale of collected materials.

4) Finally, a school recycling project can provide an important public service by serving as a recycling depot for the surrounding neighborhood. (The depot could be either a 24-hour drop-off point or a once-a-month depot, depending upon the facilities.)

When planning an in-school recycling program it is important to establish priorities. Decisions will be easier to make if participants are clear about what they are trying to accomplish.

What a school decides to recycle will depend on what is currently being thrown away and what markets are available to handle the collected items. Most schools beginning to recycle will find that paper is the most abundant material to collect. Mixed scrap (unsorted paper of all kinds) has limited rescue potential and is therefore difficult to market, so keeping ledger (high-grade stationery type paper), kraft (paper sacks and heavy postal wrapping) and newsprint separated will mean better marketability.

Other recyclable items a school might generate include: glass, aluminum, corrugated cardboard and tin cans. Whatever is to be recycled must be separated into types (glass with glass, cardboard with cardboard, etc.) paper, waxed paper, carbon paper, paper labels on cans, food, gum, etc.) For the proper preparation of each collected item, check with the people who will be collecting and/or marketing your materials.

A school recycling program may be organized by:

1) the school district administration,
2) the school's administration,
3) the student council,

4) a teacher,
5) a school class or grade,
6) a student, teacher or parent group,
7) a community recycling project not directly connected with the school.

Depending on the age or grade level, students can be in charge of most or all aspects of the program. It is important that project organizers work closely with the custodial and clerical staffs from the beginning. Cooperation from them is essential for the success of the program. A well run program should not involve any increase in the workload of either the custodial or clerical staff.

Organizing the Program

1. Identify a competent person to serve as coordinator for the effort. The commitment of this person is central to the success of the effort.

2. Have students conduct a composition study to determine the type and amount of items which are currently thrown away in the school. This will be important in determining what to recycle and in negotiating with collectors and/or markets.

3. Have students conduct an area market study. Are there markets for your potential recyclables?

a) Dealing directly with markets will mean a larger potential profit for the school.

b) Deal with an established community recycling project which will collect and market the materials for you. This would mean a lower monetary compensation for the school, but would greatly reduce the time spent managing the program.

4. Establish a planning group made up of representatives of each group that will be affected by the recycling program - students, teachers, administrators, clerical personnel and custodial staff. They will need to evaluate the composition and market studies to determine the feasibility of setting up a recycling program. Some of the questions they will need to answer are:

a) What are the goals of the recycling program, and what is the priority of each goal? (i.e., to provide hands-on recycling experience for students, to make money, to provide a community service, etc.)

IEPA AND ENVIRONMENTAL LAWS

The Illinois Environmental Protection Agency (IEPA) was created in 1970 to help solve environmental problems. Major programs at both the federal and state levels have since been enacted to deal with environmental problems. The IEPA works with other federal and state agencies, local governments, businesses and citizens on environmental issues.

The IEPA is responsible for enforcing environmental laws set by Congress and the Illinois General Assembly as well as regulations and standards established by the Illinois Pollution Control Board. Regulations are designed to protect people's health and welfare.

At the IEPA, the Division of Land Pollution Control is responsible for proper solid and hazardous waste management. The Division also administers a state hazardous waste cleanup program nick-named "Clean Illinois".

RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)

This law authorizes U.S. EPA to work for safe disposal of solid and hazardous waste. RCRA also encourages recycling and other waste minimization practices.

- U.S. EPA works with Illinois to check on the safety of all hazardous waste disposal sites and to shut down open dumps.
- IEPA tracks the movement of hazardous wastes from the places where they originate to the places where they are disposed of. Treatment, storage and disposal sites must prevent wastes from reaching ground and surface water, otherwise, they will not be permitted to operate.
- U.S. EPA must decide if it is safe to continue disposing of certain wastes in the land. If U.S. EPA misses the deadlines for these decisions, land disposal of the wastes must automatically stop.
- U.S. EPA must establish standards for tanks that store hazardous materials underground.
- U.S. EPA must establish better standards for places where hazardous waste is stored on the ground; such as waste piles.

COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT (also known as SUPERFUND)

This law authorizes the U.S. EPA to respond to waste problems that endanger public health or the environment.

- U.S. EPA, state governments, or those who caused a hazardous waste problem must clean up abandoned dumps, oil spills, and other spills of hazardous materials.

■ Cleanup costs can come from a special fund. Most of the money in the fund comes from a tax on companies that manufacture certain chemicals and petroleum.

■ U.S. EPA makes a National Priorities List of hazardous waste sites that qualify for long-term cleanup action. Hundreds of sites across the country are on the list.

ILLINOIS SOLID WASTE MANAGEMENT ACT OF 1986

The Illinois Solid Waste Management of Act 1986 was created not only to solve the landfill space problem but also to encourage the recovery of valuable commodities which are not going to landfills. The Act established a state policy for solid waste management by providing financial and technical assistance programs, as well as funding research, education and environmental protection.

The Act promotes the following waste management practices in priority order:

- waste reduction
- recycling and reuse
- incineration to recover energy
- incineration to reduce the volume of solid waste
- landfilling

The IEPA is responsible for:

- *providing grants to local governments to develop solid waste management plans;*
- *providing funds to local governments to inspect and enhance enforcement activities at landfills;*
- *providing an annual report projecting statewide landfill capacity;*
- *operating the Industrial Materials Exchange Service, co-sponsored by the Illinois State Chamber of Commerce;*
- *collecting the surcharge on landfill disposal fees that are deposited into the Solid Waste Management Fund.*

JEOPARDY

OBJECTIVE: To help students learn environmental terms.

MATERIALS: Dictionary of Environmental Terms

PROCEDURE:
1) Determine a point value to each question. Decide the length of each round.
2) Divide the class into teams.
3) Read an ANSWER from the Dictionary of Environmental Terms. For example, "To rot or decompose."
4) The first team to signal tries to give the correct QUESTION. For example, "What is decay?"
5) The team with the correct answer is awarded the point value of the question. Any team that answers incorrectly loses the points of the question. Note: *A team answer must be in the form of a question to be a correct answer.*
6) The team with the highest number of points at the end of the time period wins.

DICTIONARY OF ENVIRONMENTAL TERMS

Aquifer: An underground layer of earth, gravel, or porous stone that contains water.

Ban: To prohibit, or not allow, something.

Biodegradable: Able to be broken down into simpler products by microscopic plants and animals.

By-product: A secondary product of a manufacturing process. A waste by-product is an unwanted by-product that can either be disposed of or recycled.

Carcinogen: Something that can cause cancer.

Closed system: A system such as a spaceship or Earth in which energy, but not matter, can be exchanged with surrounding space.

Compost: A mixture of garbage and degradable trash with soil in a pile. Bacteria in the soil break down the garbage and trash into fertilizer that enriches the mixture.

Conservation: Not wasting, and renewing when possible, the human and natural resources of the world.

Contaminate: To pollute something, or make it dirty.

Corrosivity: Wastes that can damage other materials on contact.

Decay: To rot or decompose.

Decompose: To break down and change in both chemistry and appearance through the action of bacteria.

Ecology: The study of relationships between living things and their surroundings.

Environment: Everything, including living things, that surrounds a person, animal, or plant.

Erosion: The wearing away of land surfaces by the action of wind or water.

Groundwater: The supply of water under the earth's surface that forms natural reservoirs.

Hazardous waste: Ignitable, corrosive, reactive, or toxic waste that needs special care in disposal.

Hydrologic cycle: The relationship between water and the earth caused by the pull of gravity and the heat of the sun. Also called the water cycle.

IEPA: Illinois Environmental Protection Agency

Ignitability: Wastes that may catch fire.

Incinerator: A furnace that burns under controlled conditions.

Leachate: Rain water or liquid that has percolated through solid waste and has extracted possibly poisonous dissolved or suspended materials from it.

Litter: Trash scattered about indoor or outdoors.

Methane gas: A highly flammable and explosive gas, both odorless and colorless, produced by decomposing garbage or other organic material.

Mobile source: A moving source of pollution, such as a car or truck.

Monitoring wells: Wells used only or primarily for periodic testing purposes.

Natural resource: Materials that are found in or on the earth which are used to make useful objects or provide energy.

Nonrenewable materials: Earth materials in limited supply. Some may be used only once, such as fuels. Others may be recycled for further use, such as steel or motor oil, even though petroleum and metal ores do not renew themselves in the earth.

Plastics: Man-made materials that can be formed into objects.

Persist: To live on, to last for a long time.

Plume: An area of spreading contamination as it moves away from the source.

Pollute: To make the land, water, or air dirty and unhealthy.

Pollution: Whatever makes land, water and air dirty and unhealthy.

Reactivity: Wastes that react violently with water and may catch fire or explode.

Recycle: To reuse waste materials.

Renewable materials: Examples are trees, plants, animals and water.

Residue: Something that remains, or is left over.

Resources: Air, water, soil, trees, plants, minerals, wildlife and other things that make up the natural wealth of the earth.

Runoff: Water from rain, melting snow, or irrigation that flows over the ground and returns to streams, sometimes carrying with it pollutants picked up from air or land.

Sanitary landfill: Site where garbage and trash are taken and covered daily with a layer of soil. A sanitary landfill keeps pests away, holds litter in place, reduces runoff of wastes during rain, stops smells and prevents fires.

Sewage: The organic waste and wastewater that comes from homes, farms and businesses.

Site: Place or location.

Sludge: Material found in wastewater treatment plants that is made up of tiny particles of solid wastes loaded with pollution-eating bacteria.

Solid waste: Trash and garbage without enough liquid to flow freely.

Solid waste collection: The act of picking up trash and garbage and hauling it to landfill or disposal sites.

Standard: Limit on the amount of pollution that can be produced.

Stationary source: A non-moving source of pollution, such as a factory smokestack.

Surface water: Water that collects on the ground, like rivers and lakes.

Toxic: Poisonous.

Toxicity: The degree to which a substance is poisonous to plants to animals.

Treatment: Use of chemical, biological, or other processes to make waste less toxic or non-toxic.

Wastewater: Water that carries solids, and that comes from homes, farms and businesses.(See sewage)

Water cycle: See hydrologic cycle.

ADDITIONAL CLASSROOM AND OUTSIDE ACTIVITIES

1. Survey home for common household waste that may be considered hazardous. Use survey form and classify as to type. Compare results. Determine the most common type and devise a safe method for disposal.

2. Interview (or invite to class) a senior citizen to find out about his childhood experiences with hazardous waste. Compare what we know about hazardous waste today with what was known in the past.

3. Survey local stores and observe packaging of materials. Classify as: convenience, superfluous, or essential packaging.

4. Compare three standard picnic baskets emphasizing:
1) *low cost,* 2) *convenience,* and 3) *low environmental impact.*

Basket one could contain home wrapped sandwiches, bagged potato chips, canned soda and candy bars. **Basket two** could contain a lunch from a fast food restaurant chain which uses considerable paper packaging. **Basket three** should contain foods which leave little or no waste such as apples, carrots, cheese, etc.

Compare the waste produced by each and discuss the implications about our lifestyles.

Eat the picnic foods.

5. Have students write a poem or short story on the subject of "how my generation improved the earth."

6. Form a "web of life" using string and allowing students to represent animals, food sources, industry, etc. Discuss how the alteration of one member affects all members of the community.

7. Discuss available jobs that have to do with waste management. For example, engineers design landfills.

8. Organize a community clean-up campaign. Students can advertise the clean-up event, help collect the trash and help transport it to a proper landfill.

9. Have students identify a waste problem in our community and design a plan to resolve it. Stress that students should not move or touch abandoned items suspected of being hazardous waste. Review what authorities to contact if such a discovery is made.

10. Make posters for the local public library about proper management of solid wastes and hazardous wastes.

11. Students can discuss with parents and other relatives the stewardship of the earth and help them to become better stewards.

12. Students can give programs on solid wastes and hazardous wastes to civic groups.

13. Write letters to companies which produce hazardous waste asking them how the waste is handled.

14. Collect newspaper articles about hazardous and solid wastes and prepare a display on a bulletin board.

15. Visit local retailers such as hardware shops, grocery stores and garden shops. Search for materials which may be considered hazardous waste if improperly disposed of.

16. Survey the home and compile a hazardous waste list. Combine the entire class results and determine the most common home hazardous waste.

17. Make an exhibit for your school or library on the environment.

18. Visit a local landfill.

19. Draw a map of your community showing where sources of pollution are located.

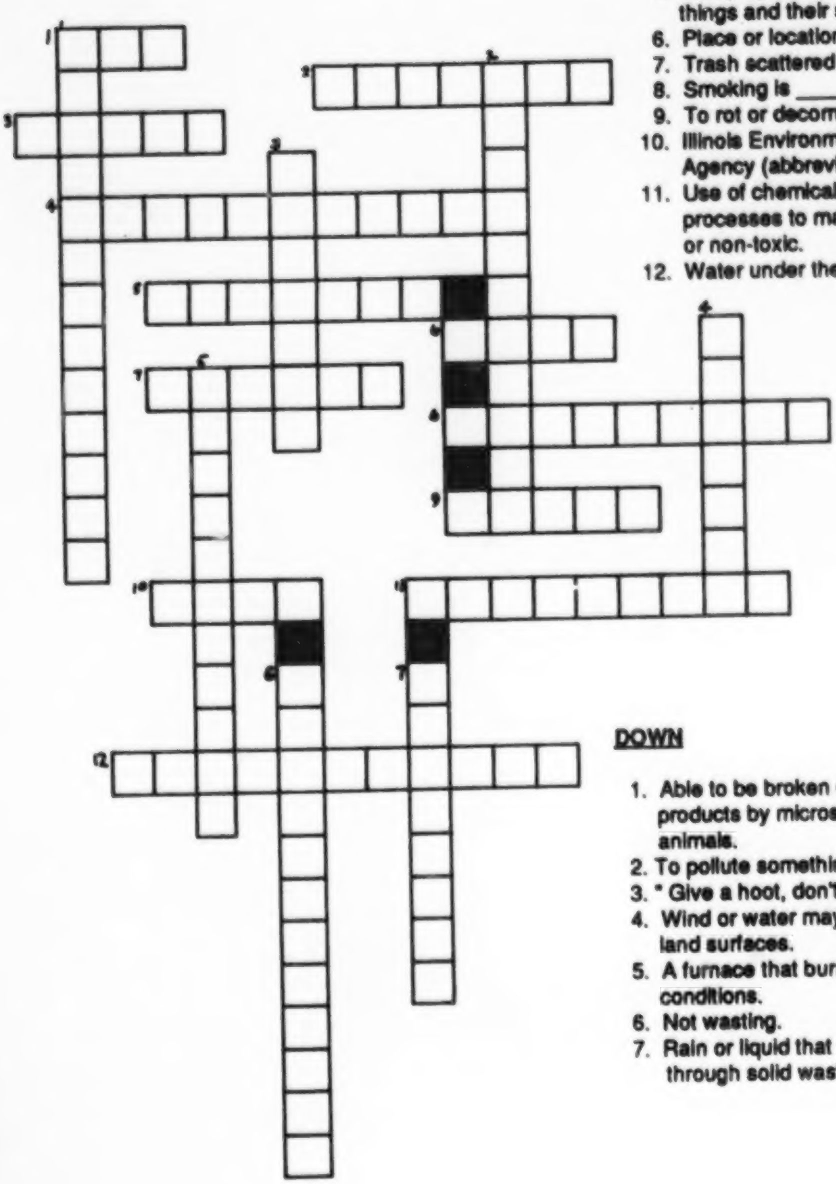
20. Have a member of a community anti-pollution organization talk to the class about pollution problems and solutions.

21. Help to plan a special program on pollution for the school.

22. Interview polluters in your area for a school newspaper and describe their pollution control problems and efforts.

23. Organize a debate in school to defend and oppose the statement: "Environmental legislation and enforcement are necessary to protect land quality."

CROSSWORD PUZZLE FUN



ACROSS

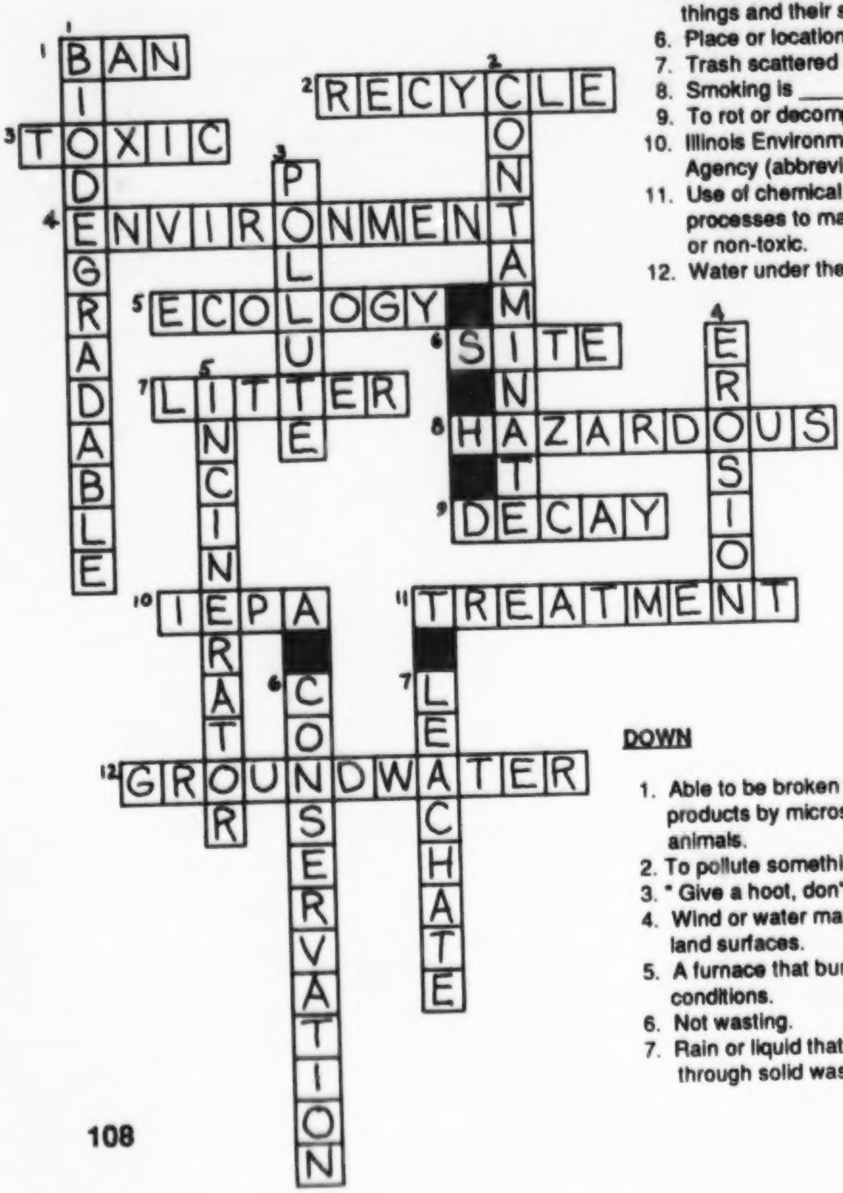
1. To prohibit.
2. We should _______ aluminum cans.
3. Poisonous.
4. Learn to protect your ___________.
5. Studying relationships between living things and their surroundings.
6. Place or location.
7. Trash scattered about.
8. Smoking is _______ to your health.
9. To rot or decompose.
10. Illinois Environmental Protection Agency (abbreviate).
11. Use of chemical, biological, or other processes to make waste less toxic or non-toxic.
12. Water under the earth's surface.

DOWN

1. Able to be broken down into simpler products by microscopic plants and animals.
2. To pollute something, make it dirty.
3. " Give a hoot, don't ________!"
4. Wind or water may cause ________ of land surfaces.
5. A furnace that burns under controlled conditions.
6. Not wasting.
7. Rain or liquid that has percolated through solid waste.

Crossword Puzzle - Answer Key

CROSSWORD PUZZLE FUN


1 BAN
2 RECYCLE
3 TOXIC
4 ENVIRONMENT
5 ECOLOGY
6 SITE
7 LITTER
8 HAZARDOUS
9 DECAY
10 IEPA
11 TREATMENT
12 GROUNDWATER
1 BIODEGRADABLE
2 CONTAMINANT
3 POLLUTE
4 EROSION
5 INCINERATOR
6 CONSERVATION
7 LEACHATE

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(Materials may be taken directly from reference).

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